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AND

DISEASES OF THE THROAT.



LESSONS
IN
LARYNGOSCOPY:
INCLUDING
RHINOSCOPY
AND
THE DIAGNOSIS AND TREATMENT
OF
DISEASES OF THE THROAT.

BY
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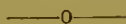
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P R E F A C E.



THIS little volume is essentially practical. It is based on many years' experience in practising and teaching the Art of Laryngoscopy, the author's first *public* demonstrations having been given at the Metropolitan Dispensary early in 1860. In the following and several successive years his clinical lessons were repeated at the City Dispensary, and next at the North London Consumption Hospital. His demonstrations were subsequently given at the Hospital for Diseases of the Throat, where they are still continued.

The author hopes the work may prove acceptable to those of his pupils who have urged him to collect into a small volume his directions on Laryngoscopy, many of which have been scattered through the Reports on

Diseases of the Throat and Lungs, which he is editing for the *Medical Press*.

The plates speak for themselves, and will no doubt be duly appreciated. Neither trouble nor expense has been spared to make them faithful pictures of the cases from which they have been painted.

29 ALBEMARLE STREET,
November, 1873.

LESSONS IN LARYNGOSCOPY.

I.

Introductory. Early use of Mirrors by Dentists. Laryngoscopy. Reflected Light. Forms of Apparatus. Shapes of Laryngeal Mirrors. Supports of Reflectors. The Light. Forms of Lamps. Direct Light. Concentrators.

LARYNGOSCOPY (Λάρυγγ σκοπέω) is the art of examining the interior of the larynx. This is accomplished by means of a mirror sometimes called the laryngoscope, but this name is more usually assigned to the complete apparatus used to obtain a view of the larynx.

It is obvious that a dark cavity situated in such a position as the organ of voice can only be seen in the living person by the aid of a reflector. In fact, in the practice of laryngoscopy we do not look at the interior of the larynx itself but at its image in a mirror.

The laryngoscope, then, is only a contrivance to enable us, so to say, to see round a corner, and it is a little remarkable, considering the length of time that reflectors have been employed for similar purposes, that physicians should not long ago have availed themselves of the same principle.

In its very simplest form the laryngoscope may be said to exist in the mirrors used by dentists, and indeed the earliest efforts at laryngoscopy consisted in the use of such mirrors mounted on a long handle. The difficulty was so to place the patient as to allow sufficient light to fall upon the mirror, and practically this was not attained until a second mirror was used to reflect the rays and direct them upon the first.

This was essentially the starting point of laryngoscopy. Nevertheless, the simpler method of utilising the direct rays of light involves the principle of the laryngoscope, and those who persevered in the attempt thus to obtain a view of the larynx are entitled to the credit of having in some degree contributed to the progress of the art.

A second great step in advance was the employment of artificial light, for this being always at command experiments could be carried on at any hour and in any room.

As soon as this step was taken the modern laryngoscope may be said to have been completed ; for the many variations in the shape of the mirrors, the mode of supporting the reflector or the lamp, can scarcely claim to do more than render the apparatus more convenient.

This brings us to a consideration of the several forms of laryngoscope in common use. To describe them it is necessary to take each portion separately.

The most important part of the apparatus—the laryngoscope itself, so to say, is the faucial or laryngeal mirror, as it is designated. It consists of a plane reflector mounted on a long stem. It may therefore be made of silvered glass, of burnished steel, or of any other good

reflecting surface. Steel, however, is very apt to rust, and ordinary looking-glass is therefore most commonly used.

The shape of these mirrors has been discussed with some gravity, but is a matter of little importance. Some prefer them round, others think square, with the corners rounded, more convenient. Others maintain oval ones to be best. It is easy to see with either. Where the tonsils are enlarged an oblong shape may be essential, and in a few other cases it is very convenient.

The shape of the stem is equally a point of little importance. The mirrors may be mounted on a handle, similar to an ordinary pen-holder, or they may be furnished with any other stem. The illustrations on page 4 (Fig. 1) show the more common forms. The square mirrors are preferred by many French authorities, and these illustrations are taken from them. The round ones with the handle are an English model, made by Maw, who also supplies the French shape.

It will be seen that a single handle is made to serve by means of a screw for various sizes of mirrors. This is convenient for portability. To increase this convenience I have had them made to slide in the whole length of the handle, an improvement that has been adopted by many. I have also had made a much more slender handle, bent at a right angle, and with a telescopic slide. This is the most portable instrument made. It will be seen that the mirrors are mounted at angles of about 120 degrees. This is the most convenient for general use, and it can easily be varied by bending the flexible stem to suit special cases. In hospital practice it is better to have a large number of mirrors, mounted at different angles

and of all sizes ; but for ordinary cases the three sizes depicted, and the angle mentioned will suffice.

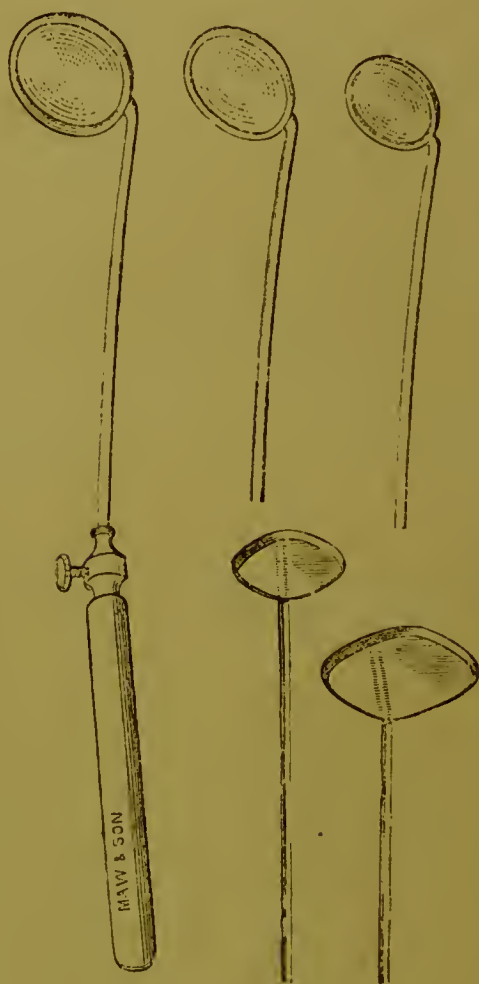


FIG. 1.

The next part of the apparatus is the reflector. This is only a concave mirror, by means of which we can divert the light wherever we please. Whether it should be perforated in the centre, like the ophthalmoscope, has excited some controversy. One of the earlier shapes is seen in the accompanying cut (Fig. 2).

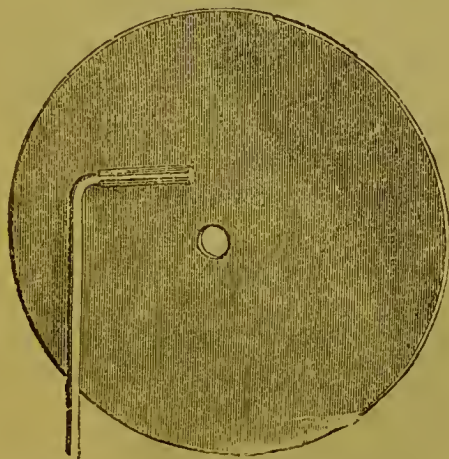


FIG. 2.

The mode in which the reflector is supported is the next point. I have tried all plans, and am not particular which I use. In the early days of laryngoscopy I had a reflector mounted on a distinct stem to stand on a table (Fig. 8, p. 12). I still sometimes employ it in the consulting room; but it is not portable in comparison with other modes. Czermak had a mouthpiece to hold it by the teeth, and Messrs. Weiss made me an instrument on his model, which I have used for many years. It is not easy for those whose teeth are defective. Semeleder, Stellwag,

and others had the reflector mounted on a pair of strong spectacle frames, an arrangement adopted by many others, the frame having been rendered lighter by Mackenzie's suggestion to dispense with the upper rim. These frames can also be fitted with a suitable concave or convex lens to suit the sight of any operator, or with a pair of different focus for persons who are very binocular. This I consider important, as many persons require a correcting lens. Indeed, in teaching, I become more and more convinced of the importance of the learner adopting such a lens as may be desirable, even though his vision be such as he may have previously considered normal.

Frames of this kind have been lately furnished by Messrs. Mayer and Melzer to pupils at the Hospital for Diseases of the Throat.



FIG. 3.

Messrs. Arnold also made them for me at an early period, and now keep in stock a case which the above illustration shows to be very portable (Fig. 3).

Schrötter prefers Kramer's forehead-band, and in this he is strongly supported by Dr. Johnson, who also dispenses with the central perforation.

That the forehead-band forms a good support, and is easy to use, is undeniable. This illustration will serve as a sufficient description, *a* being the reflector, supported by band, *b d*, which can be lengthened or shortened by buckles, *c c*.

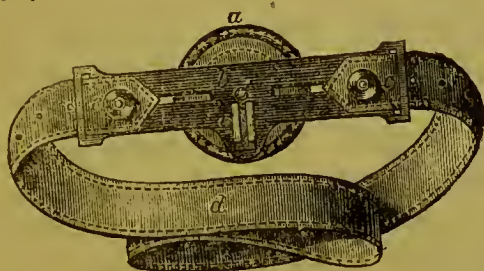


FIG. 4.

The forehead band may also be used to support the reflector when it is perforated and placed before the observer's eye, as in Fig. 5.

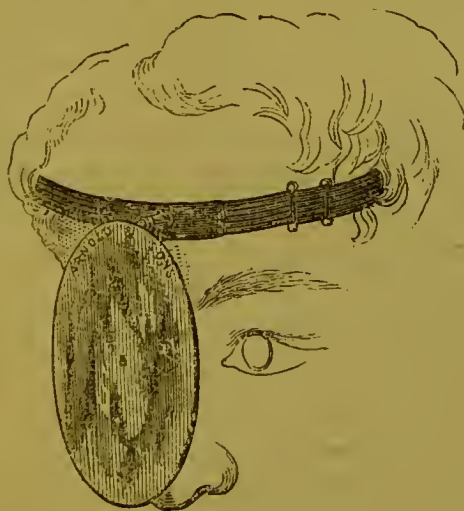


FIG. 5.

That the mode of supporting the reflector is of little consequence becomes more manifest when we remember that reflection can be dispensed with altogether. As already stated, we can practise laryngoscopy by means of direct light alone. If the laryngeal mirror be properly held, a beam of light, from any source, falling upon it is sufficient to furnish an image of the larynx. The difficulty is for the observer to look at the mirror without intercepting the rays of light by his own head. This is why it is easier to sit before a looking-glass and examine one's own larynx by direct light. For this purpose the solar rays may be employed when obtainable, but in all cases artificial light is more manageable. The light of an ordinary moderator lamp is sufficient for all practical purposes. In fact, it is with such a light that some of the most valuable discoveries have been made. Where gas is laid on, a good argand burner is most convenient. The light from either of these may be increased by an ordinary metal reflector placed behind ; or in place of the ordinary glass chimney a metal one, with an aperture on one side, will not only increase the light at the operator's disposal, but prevent its diffusion through the room, and thus obviously afford a clearer view of the image. Further, if a plano-convex lens be fitted into the aperture of such a chimney, it constitutes at once a simple and efficient light concentrator. This mode has been adopted by many laryngoscopists for obtaining a good light for ordinary use with a reflector.

In my early experiments with direct light I employed a small lamp with a single lens on one side, and a reflector at the back—a lantern in fact, such as that used by police-

men, and sometimes for railway signals. Dr. Brunton's aural lamp is an improvement on this. Tobold's apparatus, which contains three lenses adjusted in a tube, may be also used for experiments with direct light, and it is now made much more portable than formerly. A good lens attached to a pair of spring forceps that will clasp any lamp, serves also as a simple laryngoscope for the use of direct light. Such an instrument is sold as Dr. Johnson's.

Dr. Fauvel, of Paris, has improved upon this by devising a very simple and portable laryngoscope, the use of which is shown in the annexed engraving (Fig. 6).

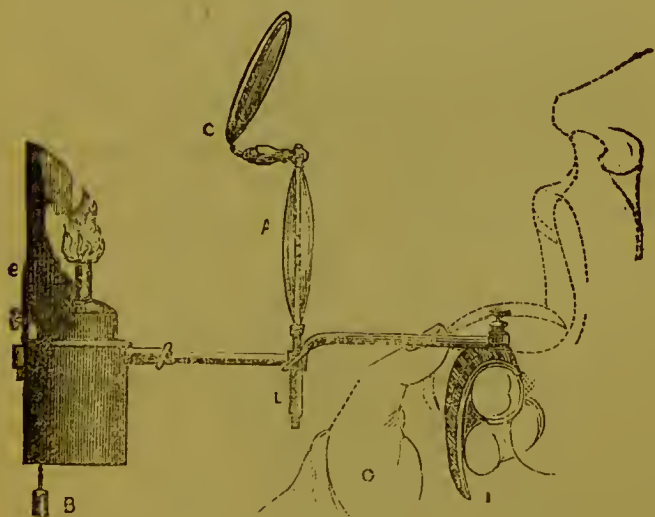


FIG. 6.

This instrument can be used in any position. The illumination is obtained by direct light, passing from the lamp through the lens A. A tongue-clasp is also attached,

but this is not often required. The little lamp is very useful for examining a patient in the recumbent position; but this can be dispensed with, and the Fauvel lens used with any lamp, thus combining the advantages of this apparatus with those of Dr. Johnson's.

The little plane mirror (c) above the lens may be placed at such an angle as to let the patient see his own larynx. This mode may therefore be used for demonstration.

I have tried to utilise the magnesium light for laryngoscopy, but it is very unmanageable. I have for a long time employed the oxyhydrogen lamp, which furnishes a good light equally available for use directly or by reflection. At the Hospital for Diseases of the Throat there is a very good lamp of this kind, which is of great use for demonstrations, the direct rays being always employed. It is too large for the private consulting room, but for hospital use is of great value.

But the purest and brightest artificial light of all is the electric. The difficulty of employing it is that so few electric lamps are simple in construction and therefore easily managed. Mr. Browning has dispensed with all clock-work in his electric lamp, but in addition to its cost, which is considerable, it requires a very powerful battery—from twenty-five to forty large cells—and that in its turn demands much attention.

For ordinary use, then, we are driven to the conclusion that gas is the most convenient source of light, and the brilliancy of this can always be increased by burning with it a small proportion of oxygen. A small apparatus for this purpose can easily be affixed to any burner.

Instead of a lens a glass globe, filled with water, may

be placed before the lamp. Türk appears to have been the first to try this mode of illumination, which is still constantly used by Störck, one of the most able teachers of laryngoscopy. As a support, Türk used a single rod, so bent as to cause the centre of gravity of the globe to fall about the middle of the heavy foot. Störck suspends the globe from the top of the frame by a screw, which enables him easily to alter its height (Fig. 7).

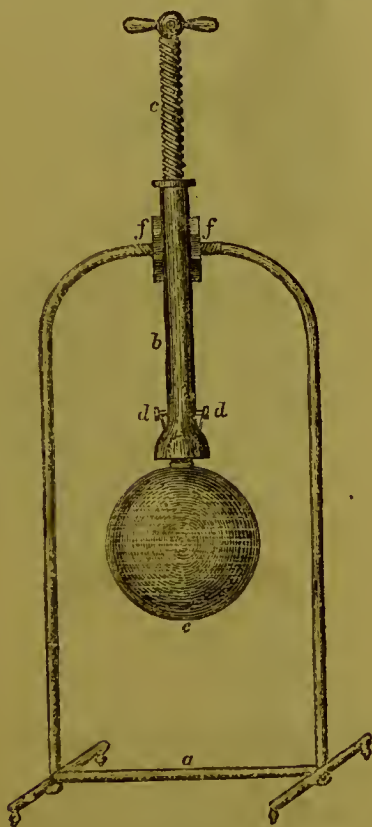


FIG. 7.

a, foot; *b*, support; *c*, screw to adjust height; *d*, adjusting nut; *e*, globe; *f*, joints.

Dr. T. J. Walker, of Peterborough, modified this apparatus by suspending the globe from a cross-bar, which is supported by two upright metal rods. Moreover, he added to it a small plane mirror, thus enabling the operator to examine his own larynx, and at the same time show it to others.



FIG. 8.

From the dawn of laryngoscopy—before Czermack's book was translated—I have used a reflector supported on an upright rod, the upper half of which slides into the lower, for varying the height (Fig. 8); and this method has been adopted by several others.

These instruments are all more or less adapted for demonstration. Dr. Smyly, of Dublin, has devised for this purpose a very simple and ingenious method. He uses a perforated reflector supported by a forehead-band to which is fixed a square plane mirror. The reflector is fixed as usual before either eye, and the square mirror into which the pupil looks, covers the other, as is very well seen in the following engraving.



FIG. 9.

II.

The Practice of Laryngoscopy. Position of the Patient and Physician. Warming and Introduction of the Mirror. Control of the Tongue—by Tongue Depressors, by holding. Cautions and Directions.

To obtain a view of the interior of the larynx the operator, seated in front of the patient, has only to place in the fauces the warmed laryngoscope and direct a stream of light upon it. The most convenient position is for the patient to sit upright with the head leaning very slightly backwards. The distance of the physician from the patient should be such that the reflector brings the light to a focus, about the base of the uvula. With the ordinary sized reflector this will be from thirteen to fifteen inches. The lamp may be on either side of the patient according as the reflector is before the left or right eye of the observer. The flame should be about the level of the patient's eyes. The exact position of the lamp is a point of detail that is of little moment ; for the observer soon learns so to place it as to receive the light on his reflector from which he can throw it in any direction. The light being thus under control, the patient opens the mouth as widely as possible ; the rays are brought to a focus in the fauces ; the laryngeal mirror is warmed, and at once so placed as to gently press the uvula backwards and upwards. The position of the parties is clearly shown in the

engraving, (Fig. 10) which represents the simplest method of laryngoscopy by reflected artificial light, and has been accurately copied from a photograph taken for me several years ago. It will be observed that no mode of controlling the tongue is here employed. Some patients, like the one from whom the photograph was



FIG. 10.

taken, can completely display the fauces, holding the tongue well down all the time. In others, however, and they are the majority, the tongue involuntarily arches itself, and renders it impossible to see the fauces. To meet this inconvenience tongue depressors

of various shapes were first of all employed. Those resembling a paper knife are the most simple (Fig. 11),



FIG. 11.

but like the double folding one (Fig. 12), they are unsatisfactory both for laryngoscopy and other purposes.

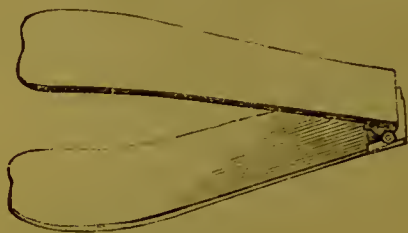


FIG. 12.

Before the discovery of the laryngoscope I had constructed an oval-bladed depressor, which holds the tongue firmly. The blades were of two sizes, and screwed into an ebony handle. The instrument is therefore portable. This tongue depressor (Fig. 13) is the most convenient instrument for rhinoscopy, as the examination of the posterior nares by means of the faucial mirror is called.

Türk's depressor is stronger, and for operative procedures more complete, but it is less portable. The patient can easily hold it in position himself. Voltolini's is also an excellent instrument.

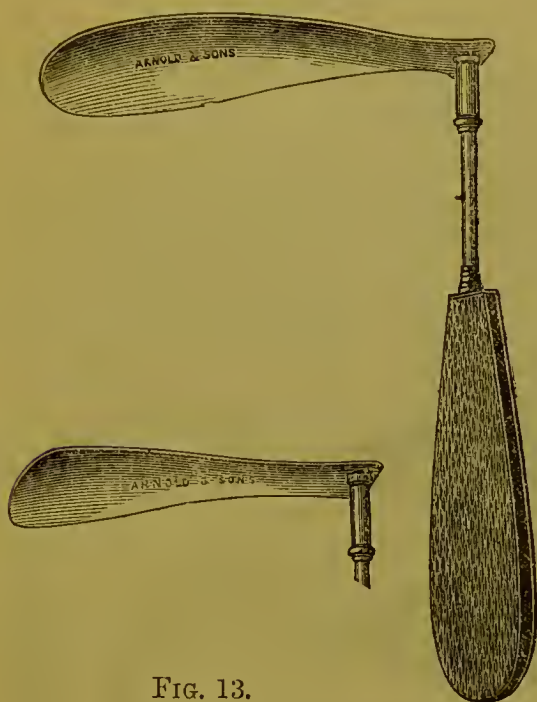


FIG. 13.

Leiter, of Vienna, makes a depressor consisting of a Türk's hooked handle, furnished with blades of the shape depicted in Fig. 14.



FIG. 14.

I have so modified the last-named instruments as to make them much more generally useful. I have the hooked handle made more slender than usual, and the blade fitted by a circular shoulder instead of a square one. They can therefore be fixed in any position by a mere turn of the screw. Fig. 15 shows my latest depressor with three blades, but of course additional ones may be had if required. Useful as depressors are for operative purposes, they are seldom required for diagnosis.

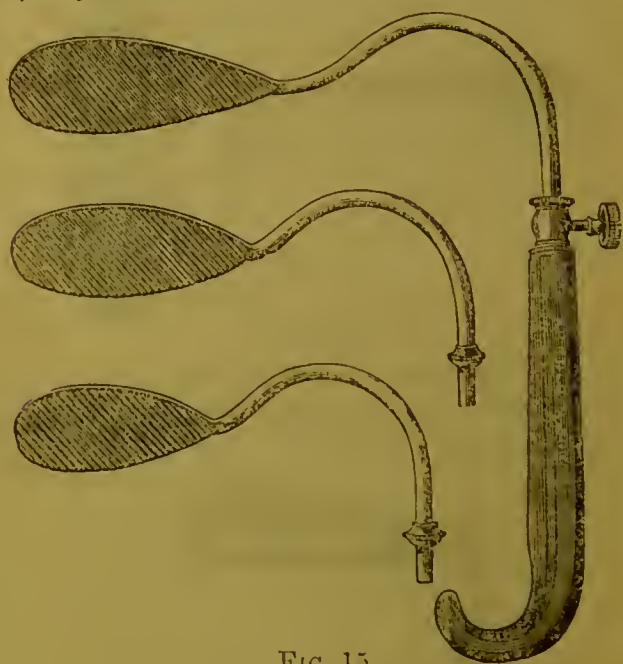


FIG. 15.

For ordinary laryngoscopy the best plan is to direct the patient to put out his tongue, and for the operator to hold it gently but firmly with the thumb and forefinger covered with a small napkin. This prevents it from slipping, and

a clean one can be used for every patient. It is not necessary to drag upon the organ, and the finger should be kept just above the level of the teeth to prevent their injuring its under surface.

It is absolutely necessary to warm the laryngeal mirror, or the moisture of the breath will at once condense upon it and obscure the view. It may easily be held for a few seconds over the chimney of the lamp.

When direct light is used a small spirit-lamp in any convenient position will serve the same purpose. The temperature is to be invariably tried on the back of the operator's hand, or on his face, for if it be so hot as to burn the patient he will naturally lose confidence in the physician, and perhaps decline a second attempt. In holding the mirror over the lamp a film of moisture momentarily condenses upon it, and at once clears off. It is then warm enough, but may be too hot. Hence the necessity for the precaution named.

The mirror, when warm, should be carried boldly forwards into the fauces, particular care being taken not to touch the tongue, as that will be likely to excite retching. The posterior surface of the mirror should push the uvula *without hesitation* somewhat backwards and upwards. There is no fear that this will cause irritation, while a trembling, hesitating way of holding it only produces an unbearable tickling. I have known many beginners utterly fail from tremulousness. The throat is far more tolerant of the contact of instruments thus suddenly pressing against it, than of the vibrations of a body held unsteadily. Of course force is not needed, but some degree of pressure is less intolerable than tickling.

III.

The Laryngeal Image. The Vocal Cords. Other Parts Reflected. Parts of the Cavity of the Larynx. Appearance of the Cords.

WHEN the mirror has been introduced and the full light directed upon it the operator will have a view of the parts in the line of reflection.

If the directions already given have been followed and the conformation of the parts be normal, an image of the interior of the larynx occupies the mirror, the vocal cords arresting attention by their movement as well as by their white colour, which is in striking contrast with the surrounding parts.

If the mirror should not have been carried far enough back—a common error with beginners—or if it be otherwise improperly placed, of course this view will not be obtained. In the former case rectification is easy, in the latter the mirror should be withdrawn and re-introduced.

It is not uncommon for the beginner to see only the base of the tongue and upper surface of the epiglottis, or if he have carried his mirror far enough he may even then only see the under surface of the epiglottis.

I have even known the mirror to be so held at first as

only to reflect some of the teeth, and yet the learner has very soon become an efficient laryngoscopist.

To some beginners, the sudden appearance of the teeth instead of the vocal cords in the mirror, is quite startling. A moment's consideration of how they are holding the mirror removes their perplexity.

The view, moreover, will vary somewhat with the conformation of the individual, but most of all with the angle at which the mirror is held, and this may be varied to any extent.

A single demonstration will suffice to teach a pupil so to hold the mirror as to see the vocal cords in action.

It is easier, in fact, for a student to learn this from a competent professor than to comprehend and appreciate the printed directions.

I first speak of the vocal cords, because in his very first lesson the student ought to see them distinctly and notice their vibration. From that moment he will never forget their appearance and he will feel more interest in his work; moreover, they will serve as land marks for the study of other parts of the larynx. The laryngeal image is seen in the engraving on the next page (Fig. 16), which represents the mirror (B) held over the larynx (A), and reflecting an ordinary view of the cavity.

In this figure, A is the anterior view of the larynx, merely introduced to show its relative position to the mirror B, in which the reflected image appears. The epiglottis is marked *a* in both figures. The right and left vocal cords of the patient are marked *r* and *l*, and the arytenoid

cartilages, which are also prominent parts in the view are marked *b* and *b'*.

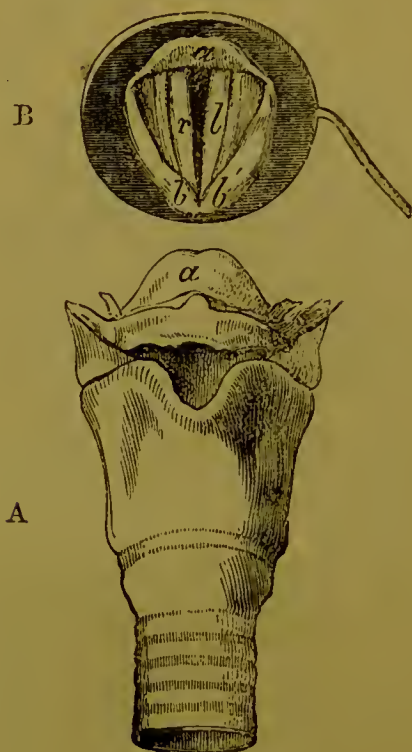


FIG. 16.

In the next figure (17) there is presented a view of nearly all the parts likely to come into view in the attempt to see the interior of the larynx. The laryngeal image, as seen in a moderate sized mirror, is included in the dotted circle. This engraving is copied from Türck (*a*), with the exception of the dotted circle, which was added by Dr.

Walker (*b*). Several parts, such as the base of the tongue, will at once be recognised, while the laryngeal image is more complete than in Fig. 16. Thus the letter *g* points to one of the true vocal cords, while *h* indicates one of the so-called false cords; *i* is the rima glottidis or opening between the true cords; *e*, the arytenoid cartilage surmounted by the capitulum Santorini, and close to this is the cartilage of Wrisberg, *f*.

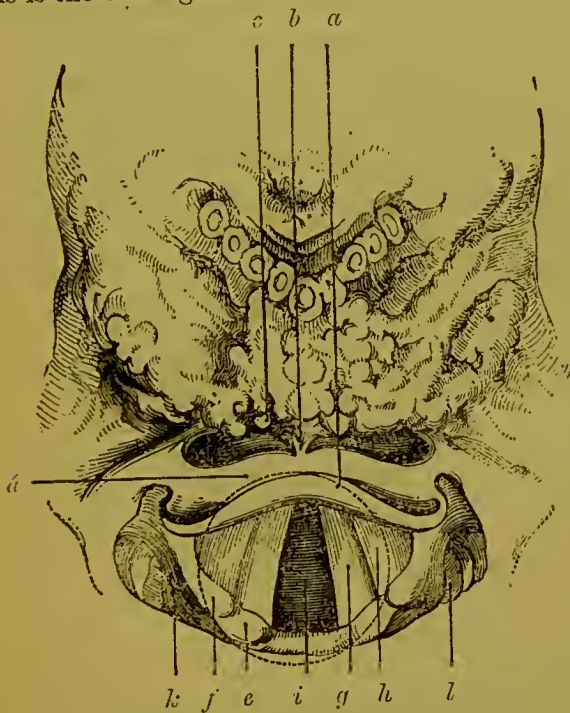


FIG. 17.

FIG. 13.—Base of tongue and larynx. *a a*. Epiglottis; *a*. Its lip; *a*. Its anterior surface; *b*. Glosso-epiglottic ligament; *c*. Vallecula; *e*. Arytenoid cartilage surmounted by the cartilage of Santorini; *f*. Cartilage of Wrisberg; *g*. True vocal cord; *h*. False vocal cord; *i*. Rima glottidis; *k*. Outer surface of aryteno-epiglottic folds; *l*. Inner surface of wall of pharynx.

(*b*). The Laryngoscope in its clinical applications.

The epiglottis is marked *a*, as in the previous figure, *b* is the glosso-epiglottic ligament, and *c* the valecula.

It may be thought that the crowding of these parts into one engraving is unnatural. Still the figure gives a fair idea of the relative position of the parts likely to be reflected in the mirror during the student's early attempts to explore the larynx, while the dotted circle directs his attention to the ordinary laryngeal image. With every detail of this image he must be thoroughly familiar, and he will soon find that in the normal condition it varies considerably in different persons. Moreover, he will be prepared to watch its extensive changes during respiration and phonation. To assist in the recognition of the several parts an unlettered engraving of a laryngeal image is added (Fig. 18).

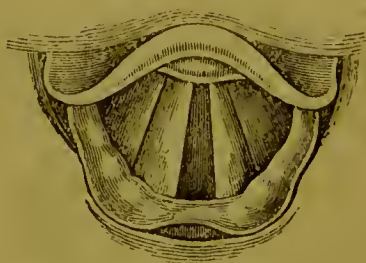


FIG. 18.

This, it will be observed, is a fuller view than the preceding one. The cushion of the epiglottis is distinctly seen immediately under its lip. The glottis itself is not quite so open, and there are some other differences between the two figures of which the student should make a careful comparison.

I have already remarked that the vocal cords are in remarkable contrast with the other parts. It is impossible, therefore, to mistake them. They appear as two flattish, white bands connecting the base of the arytenoid cartilage with the angle of the thyroid cartilage. They are seen to move with the respiration, opening widely in inspiration and partially closing in expiration, but the movement is most posteriorly, where the separation may be from a quarter to half an inch in distance. The angle at the base of the arytenoid cartilages into which the cords are inserted is called the *processus vocalis*. As the vocal cords approximate this angle is turned inwards, but when they separate it turns outwards, so that in inspiration the glottis has what has been called a lozenge-shape. The vocal process above described served Longuet for a division of the glottis into the inter-cartilaginous and inter-ligamentous portions.

IV.

Difficulties and Obstacles. Movement of Mirror. Retching. Arching or Thickness of the Tongue. Enlarged Tonsils. Irritability of the Fauces and means of relieving this Condition. The Uvula—its Elongation, &c. Rigidity of the Velum. The Epiglottis—its Form and Position, &c. Defects in Observer's Sight. Timidity of Patients, especially Children.

EXPERIENCED laryngoscopists will often place the mirror in the fauces so accurately as to obtain instantaneous views of the vocal cords in a number of cases successively. But even those in constant practice do not always thus easily succeed, though the movements they make after the mirror touches the uvula may be so slight and so rapid as to be almost unnoticed. On the other hand the beginner cannot expect to become an expert in his first lesson, and he will acquire the necessary tact more easily by deliberate movements than by any attempt at rapidity. If the image of the vocal cords does not appear at once, the position of the mirror must be altered to a slight extent. A common mistake is to move it too much, a very slight movement deflecting the rays of light to a considerable distance. This fact may be illustrated by the engraving on the next page (Fig. 19), in which M represents the position of the mirror, and G that of the glottis. A ray of light from

the observer's eye falling upon the mirror M is reflected to the glottis G, of which an image appears at M. A very slight inclination of the mirror may throw the light along either of the dotted lines, in which case the image of G will be replaced by another, A or E, as the case may be.

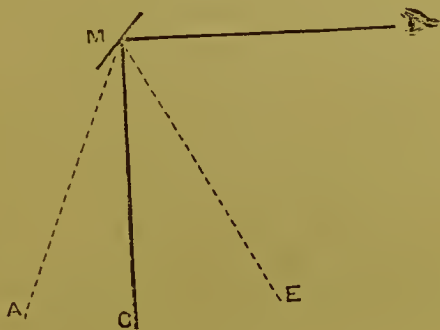


FIG. 19.

The most likely movement to be required is a slight elevation of the hand. If too near the centre and in the way of the light the hand must at the same moment pass nearer to the corner of the mouth. This movement is seldom required with my rectangular-handled mirrors, hence they are often found easier to use by learners. Whatever movement be necessary should be made deliberately and continuously, not in jerks. It can then be arrested the moment the laryngeal image is brought into view. There can be no objection to resting one or two fingers on the patient's cheek in order to steady the hand; but with practice many will find this unnecessary.

The mirror should not be kept too long at a time in the patient's mouth, nor should it be moved about too much. Retching is not so likely to be produced by two or three separate introductions. In fact, timid patients gain confidence as they find the mirror can be introduced without inconveniencing them.

This retching—the dread of patients who have never been examined by the laryngoscope, and the bugbear of those who are learning to use the instrument—is most likely to be excited by touching the tongue with the mirror. Bearing this in mind, the error will mostly be easily avoided. Another reason for care in this respect, is that the mirror becomes covered with secretion, and its reflecting power thereby diminished or even destroyed. On the other hand, while avoiding the tongue by carrying the mirror high enough, we should not let it actually touch the palate. It is, in fact, to be carried between the tongue and roof of the mouth, touching nothing until it comes in contact with the uvula. I have known beginners derive some assistance by letting the stem slide along the upper front teeth, and in a difficult case this may be done, but practice soon makes it unnecessary.

Occasionally the uvula is itself found in contact with the tongue. In this case, the patient is to be requested to take a deep breath, or to say "a" (or emit any other vowel sound), as during that act the uvula is raised, and so the mirror more easily placed.

The same plan should be adopted when the tongue involuntarily arches itself so much as to almost fill the mouth, and also in cases in which the root of the tongue seems preternaturally thick.

In the majority of cases the arching of the tongue is due to apprehension on the part of the patient, or inability to control its movements. Sir Thomas Watson (*a*) recommends in such cases, that the patient should practise before a looking-glass. It is easy thus to acquire the art of keeping the tongue in such a position as to admit of the introduction of the laryngoscope in the simplest manner, as already shown in Fig. 10, page 15.

But such complete command is unnecessary, and to acquire it occupies time. The best way is to tell the patient to put out his tongue, and to hold the protruded organ between the thumb and forefinger of the left hand covered with a napkin. This plan practised with the utmost gentleness very seldom fails.

The patient should also be told to breathe through the mouth, and not through the nose.

A very nervous patient may be advantageously set to hold the tongue himself. This diverts his attention, and should local treatment become necessary, the physician will want both his hands free.

In exceptional cases, especially in those in which the root of the tongue is unusually thick, it has been proposed to hold it by a variety of instruments. Of these, Labordette's *Spéculum laryngien* (Fig. 20), has been most used, but like many similar contrivances, has not met with general favour. It is somewhat complicated, necessitates a degree of force not so completely perceptible to the physician as it should be, and is not unlikely itself to excite vomiting or some other inconvenience.

(*a*) "The Laryngoscope." Two Lectures at the Royal College of Physicians, by George Johnson, M.D. London. 1864.

Instead of an instrument of any kind the physician's forefinger can be used, and some operators have almost entirely discarded the use of tongue depressors. It appears to me, however, that some kind of instrument is often preferable and its use seems more delicate. If "fingers were made before forks" we have not therefore dispensed with silver at table.



FIG. 20.

If any instrument be used to control the tongue it cannot be too simple. It is this quality that constitutes the value of my tongue depressor, which is so easily managed that with little practice it becomes, so to say, a mere addition of the physician's fingers. But even this

is more useful for rhinoscopy than for laryngoscopy. I have dwelt thus upon the tongue, because that "unruly member" is so often regarded by beginners as the chief impediment to rapid progress in laryngoscopy. There are, however, some other difficulties which, if only to show that they are easily overcome, it may be as well to mention here.

One of these is enlarged tonsils. A moderate degree of hypertrophy is the chief cause for the use of oval mirrors, but sometimes these organs are so much enlarged as to give rise to considerable difficulty. They are then manifestly in a condition to require treatment, which should not be delayed, unless some contra-indication exist.

Great irritability of the fauces occasionally proves an obstacle to overcome which, requires tact on the part of the physician, and confidence on that of the patient. Many cases yield to the simple plan of sucking ice for a few minutes before the introduction of the mirror. Where time is not of importance the patient may educate himself before a looking-glass, and gradually accustom the throat to the contact of instruments. Some have recommended painting the fauces with various local astringents, or saturating the sponge probang with them, and applying it from time to time. A better method of employing these remedies is by means of the atomiser. In fact a patient educating himself will find an astringent gargle, or the atomiser of great service.

A whiff of chloroform or ether has been proposed, but is not to be justified unless in urgent cases.

The internal use of the bromides has also been recom-

mended. There is no doubt that anæsthesia of the fauces, more or less complete, may be produced by these drugs in large doses, but they must be pushed to the point of saturating the system in order to attain the end, and few would think it right to subject a patient to bromism for this purpose. The use of small doses is as futile as the employment of gargles containing a little bromide, on which some have depended. An alum gargle would be far more effectual.

An irritable condition of the fauces is common in some stages of congestion and inflammation. The local remedies for these diseases are then the best applications. In laryngeal phthisis there is often great irritability, and this is mostly relieved by inhalations of atomised sprays, or of such soothing vapours as may otherwise be indicated.

Tact and gentleness will, in these cases, as well as in physiological irritability, almost always succeed, if the directions as to respiration, vocalisation, and other points be carefully followed.

The uvula occasionally proves an obstacle to laryngoscopy. Apart from irritability, in reference to which the remarks made on that condition of the fauces generally are equally applicable, the uvula may interfere with our procedure, either from its unusual size or shape. Its size may be increased in either direction, but elongation is more apt than thickness to interfere with inspection. It is no uncommon occurrence in a case with an elongated uvula for the pupil to find its tip descend considerably below the inferior border of his mirror, in which accordingly it is reflected. This difficulty is by no means

insurmountable. The use of a larger mirror will often at once overcome it. If not, the directions already given as to inspiration and vocalisation can then be carried out, and the mirror placed rapidly on the retracted uvula.

Dr. Mandl, of Paris, has devised a small pocket at the back of the mirror to catch the tip of the uvula and support it. This instrument is simple and inoffensive. Others have employed various kinds of forceps and elevators, such as are used in rhinoscopy.

Some German writers recommend passing a ligature round it to fix it—a proceeding Englishmen do not approve. If the uvula be so long or so thick as to prove a considerable obstacle to laryngoscopy, the physician should ask himself whether it be not in such a condition as to call for treatment.

Here it may be well to mention that some have mistaken for elongated uvula, a natural conformation of the parts in which the opening of the pharynx is large, and the uvula from its distance liable to fall before the mirror. This is more likely to occur if the pupil carry his mirror too far back, or attempt to support it against the pharyngeal wall. In reference to form, the uvula varies considerably, its tip sometimes being enlarged in all directions so as to form a ball at the end. Occasionally it is bifid. In all these cases choose the largest mirror for which there is room, and if necessary support it by its handle against the teeth, or by the little finger resting on the patient's cheek, and make your examination while the patient takes a deep inspiration, and then utters a falsetto note.

The same position and support of the mirror will

suffice to overcome the next difficulty—that which occurs from rigidity, not only of the uvula, but of the whole *velum pendulum palati*. This condition is mostly due to old disease, the cicatrices of which are visible. They narrow the pharyngeal aperture, and too small a mirror is apt to slip behind the velum. A large one should therefore be used, and support, if required, afforded outside. Where actual contact of the velum with the pharyngeal wall, or even adhesion is present, the conditions are somewhat different; but similar directions will suffice for the examination.

The epiglottis sometimes proves the greatest obstacle of all to laryngoscopy. This valve varies much in shape, in size, and in position, and in either of these respects may be a source of inconvenience. Instead of the shape it has already been depicted, it is sometimes asymmetrical; it is often doubled upon itself to a varying extent. In these cases the illumination of the larynx is interfered with, and we may only see one vocal cord at a time by inclining the mirror more or less to one side. Position is still more important, for if the epiglottis be too horizontal it necessarily intercepts the rays of light reflected from the mirror in the direction of the glottis. We may thus be prevented from seeing more than the arytenoid cartilages. A glimpse of these is, however, often of great value, both for diagnosis and treatment.

The most common cause of difficulty is perhaps to be traced to relaxation of the glosso-epiglottidean ligaments, permitting too great pendency of the valve. The opposite cause, however, must not be forgotten, viz., contraction or swelling of the aryteno-epiglottic folds holding

down the valve. These variations are, of course, pathological, but the natural conformation and position of the epiglottis give rise to quite as many differences. Indeed, the student should be prepared to find the epiglottis in healthy subjects varying greatly in shape, size, and position.

The difficulties caused by the epiglottis being so diverse in their origin are obviously to be met by equally varied methods, and these will exercise the patience of the student and bring out all his resources. A great number of plans have been vaunted, but no one of them can meet all the various conditions. The object is to throw the light into the larynx, and, as already pointed out the slightest variation in the position of the mirror suffices to deflect the rays to a considerable extent. Not only so, but any change of position, either of the observer or of the patient, must bring about changes in the relative position of the plane of the mirror, and that of the opening of the larynx. Thus, as in ordinary cases, we very slightly incline the head of the patient; we can, in order to meet these contingencies, either raise or depress the chin to a greater extent, so as to incline the head backwards or forwards. Such movements give a very wide range of changes. Sometimes it may be advisable further to so far change the position of patient and physician as to let the observer's eye be on a lower level than the patient's chin. He thus, as it were, looks somewhat upwards instead of downwards. In this case the patient's head is inclined forwards, and as large a mirror as convenient should be held almost or even quite horizontally immediately under the uvula, and as far from the pharyngeal wall as possible.

The reverse disposition of the parties is more frequently called for, the patient being placed on a lower level than usual, his head inclined backwards. In this case the mirror should be carried as far back as possible, and it may be necessary to change its angle somewhat. Occasionally it must even form a right angle with the stem.

Again, it is possible to change the position of the patient's larynx by manipulating the thyroid cartilage or the hyoid bone, as proposed by Türeck.

The above plans all aim at changing the relative position of the mirror and the glottis. This they do indirectly, and so to say mechanically. The same end may often be attained by a physiological method—so to say—that is, we may take advantage of the changes brought about by respiration. Thus, sometimes, deep and slow inspiration suffices; at others, the patient must be made to take a series of quick, short inspirations—to “catch his breath,” as it is said, or to draw his breath by a number of snatches. During these sudden movements the epiglottis rises, and we may get a glimpse of the glottis. In the same way a noisy inspiration—that is a rather deep breath taken with a treble note—will sometimes reveal the parts. Moreover, the movements brought about in coughing, laughing, and retching, may all be taken advantage of.

It will thus be seen that patience, combined with a knowledge of the many changes to be brought about, enables us to cope with most unpromising cases. In the most obstinate the epiglottis may be raised mechanically. Occasionally, the left forefinger of the physician can reach the valve and support it for an instant. If an

instrument be employed it cannot be too simple. A laryngeal sound will often suffice. If not, the epiglottic pincette of Fournié or Mackenzie may be used. That of Bruns is armed with teeth which are as unnecessary as they are objectionable. Others of the German school have adopted the barbarous plan of passing a ligature through the epiglottis, in order to hold it up for the inspection. I am glad that no English writer recommends this unjustifiable proceeding.

There are some other obstacles that have been commonly ranged under the head of difficulties, and which may therefore be mentioned, although they are of less importance. Thus, the instruments are occasionally at fault—the laryngoscope may be mounted at an inconvenient angle, its surface may have become impaired by the heat or rough usage, and even the reflector may not bring the rays to a focus at a convenient distance. These and other inconveniences are the concern of the maker, but at the same time it is to be expected that every observer will attend to his own instruments. The same observation applies to the lamp. More frequently the observer is himself at fault, but if in the beginning he finds some difficulty from his own inexperience or want of tact, he may be quite sure that practice will remove it.

If, however, he be short-sighted, or the reverse, this defect should be corrected by appropriate glasses.

The use of ordinary spectacles is inconvenient with any of the portable reflectors, although they may easily be employed with my detached stand. As the forehead-band or spectacle-frame will be preferred by those who have not a room devoted to laryngoscopy, I have had lenses attached

to these as already stated. It is easy therefore to correct presbyopia or myopia.

Inexperienced patients sometimes put an obstacle in the way of the observer either by perversely persisting in taking an improper position or refusing to breathe calmly and steadily. A little patience and clear instruction, if necessary by way of example, is the only resource. Some patients will begin to take deep, forcible, and rapid inspirations, while others will hold their breath altogether for a few seconds and then suddenly push away the hand of the observer. These, as well as timid patients, must be assured that laryngoscopy does not interfere with the respiration at all, and that all they have to do is to breathe quietly through the open mouth. In rare cases they may even be told to hold their own nose and so compel themselves to breathe through the mouth.

The greatest difficulty of all is presented in children of tender age and timid nature, who cannot be brought to feel confidence that they are not going to be hurt. The means of overcoming this will suggest themselves to the reader. In spite of everything, we are sometimes baffled by children, or only able to obtain a rapid glimpse of the parts. Still it is surprising how often patience and tact will succeed. It is in these cases that the dexterity and rapidity of experienced observers stand them in such good stead, and enable them to get a view of what those unaccustomed to laryngoscopy find it impossible to see.

V.

Theory of Laryngoscopy. Law of Reflection from a plane surface. Upper and Lower Parts of Image. Right and Left Side.

It is not my purpose here to enter upon the consideration of the laws of optics, some knowledge of which should be possessed by every professional man. But inasmuch as a great deal has been written upon the principles involved in the art of laryngoscopy, and numerous mistakes have been made, it seems well to state as briefly as possible the theory upon which that art depends.

Every one is aware that a pencil of light falling upon a plane polished surface is reflected from it, and nearly every student will, if questioned about it, repeat the optical law that the angle of incidence is equal to the angle of reflection. This is the law on which laryngoscopy depends, but it is more frequently repeated than thought about. The practical application is easy enough, and very little thought should prevent any one falling into the errors that some writers have committed. The student may advantageously amuse himself by correcting some of these as he stands before a pier-glass and puts to the test the statements made. In fact, a quarter of an hour before a looking-glass is one of the best preparations for a course of lessons in laryngoscopy, or may even be looked upon as the first lesson. By standing before a mirror and

carefully watching every movement he makes, the student will learn to realise more exactly the laws of reflection and the position he will occupy when he comes to examine patients. This will be more fully exemplified as we proceed ; for in the practice of laryngoscopy the physician merely observes the reflected image of his patient's larynx in a plane mirror. But it must not be forgotten that the little laryngeal mirror is held in the fauces in an oblique position forming an angle of about forty-five degrees with the horizon, and moreover that the plane of the opening of the larynx is also oblique. This opening is bounded in front by the epiglottis, which is also the highest point of the larynx and so the most prominent and as previously shown, the easiest to see in the laryngoscope. The arytenoid cartilages, the next most prominent objects, are at the lowest point. Between the two extremes are the aryteno-epiglottidean folds. Now the relative position of these parts is just the same in the image seen in the laryngeal mirror. Thus, the epiglottis appears at the summit, the folds a little below, and lowest of all the cartilages. (See Figs. 16, 17, and 18, p. 22-4) There is not then any inversion, as some have supposed. It is in another direction we must seek for the change which has led to this misconception, and which we will now consider.

In Fig. 17 (p. 23) it will be noticed that the base of the tongue is depicted at the highest part of the engraving. By holding the page horizontally the reader will observe that this makes the tongue appear the farthest off, while in reality as he sits in front of a patient he knows the tongue must be nearest.

We are able, therefore, to represent a natural view of the parts by engraving them in an inverted position thus (Fig. 21.) :—



FIG. 21.

FIG. 18.—Base of tongue and larynx. *a* *a*. Epiglottis; *a*. Its lip; *a*. Its anterior surface; *b*. Glosso-epiglottic ligament; *c*. Vallecula; *e*. Arytenoid cartilage surmounted by the cartilage of Santorini; *f* Cartilage of Wrisberg; *g*. True vocal cord; *h*. False vocal cord; *i*. Rima glottidis; *k*. Outer surface of aryteno-epiglottic folds; *l*. Inner surface of wall of pharynx.

By holding this page horizontally, the tongue is the nearest to the observer, the epiglottis comes next, and behind it is the glottis. This is the position of the parts as they actually exist in a patient, seated in front of the observer, but in the laryngeal mirror the position of

the parts is reversed—the nearest becoming the most distant. The last engraving should therefore be compared with Fig. 17 (p. 23), and afterwards with the following smaller cut. This (Fig. 22) represents the

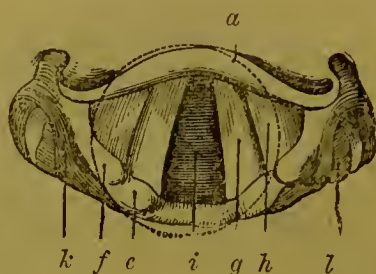


FIG. 22.

same parts except the base of the tongue, which I have not thought it necessary to re-engrave, especially as it is desirable to become accustomed to the appearance of the simple laryngeal view. Here we have the position of the parts as they appear in the laryngoscope, and as they are represented in all works on the subject, and this is the only inversion that takes place in the practice of laryngoscopy.

Some students come to us with a notion that there is a lateral inversion of the image in the laryngeal mirror. There is no such thing. The idea can only result from a confusion of terms. Right and left are words that each speaker is apt to refer to himself as a standard, but almost every clinical clerk is aware of the necessity of discriminating between the right or left side of the patient and himself. Rather ludicrous mistakes do, however, occur. For example, I have seen a gentleman listening on the

right side of a patient's chest for the sounds of the heart, and another tapping the left epigastric region to elicit the dullness he was taught to seek for over the liver. The same confusion lurks in the error about lateral inversion in laryngoscopy. The physician sits opposite to the patient and looks at the image formed in the mirror held in the fauces. The right hand of the physician is therefore immediately opposite to the left hand of the patient. It is the same with every other part—the right foot or right eye of every observer is opposite the left of a person facing him. In learning the use of the ophthalmoscope, the student does not so readily fall into error, because it is so much more easy to correct himself, as he only examines one eye, right or left, at a time.

In the laryngeal mirror, however, he sees both vocal cords at once, but they are not inverted. He must remember that it is the image of the patient's cords he sees, not his own. The standard of right or left must therefore be referred to the patient, and then it will be manifest that as the left vocal cord of the patient is opposite the right of the physician, so it appears on what the observer calls the right side of the mirror, but what would be called by the patient its left side.

All this is readily seen in Fig. 16 ; and it may be rendered still plainer by the engravings on pages 44 and 46. The first, Fig. 23, shows the laryngeal image as reflected in the laryngoscope, while the one below, Fig. 24, displays the actual relation of the parts to each other in the patient's larynx. Fig. 26 is the same on an enlarged scale.

The correctness of the foregoing statements respecting inversion admits of the easiest experimental proof at the

hand of every reader. Standing in front of a swing toilet mirror, the upper part of which is inclined forwards, so as to represent the position of the laryngoscope in a patient's fauces, he has only to place this book on the stand, and examine the image of the engraving, Fig. 24, as reflected in the glass. He will thus satisfy himself of the accuracy of what I have said. Nor is an engraving necessary for the experiment, though as it represents the parts to be seen it is more striking.

FIG. 23.



FIG. 24.

Figs. 23 and 24 : *r* right, and *l* left vocal cords ; *ep* epiglottis ; *c* posterior commissure of glottis. An enlarged view is given on page 46.

The letters on any page are reflected in exactly the same way. They appear in the glass upside down, but they do not read from right to left. There is no lateral reflection. We may illustrate this by the word glottis

in the following diagram, which below (a) is naturally placed, but is seen in the glass as at (b).



FIG. 25.

The same facts may be illustrated still more aptly by taking an ordinary laryngeal mirror and holding it over any of these pages in a similar oblique position. In that mirror the reader can examine any of the engravings and see them just as he will see the patient's larynx ; and the learner will find it excellent practice. If less to the purpose, the reading of the letterpress thus reflected is . both instructive and amusing.

FIG. 26.

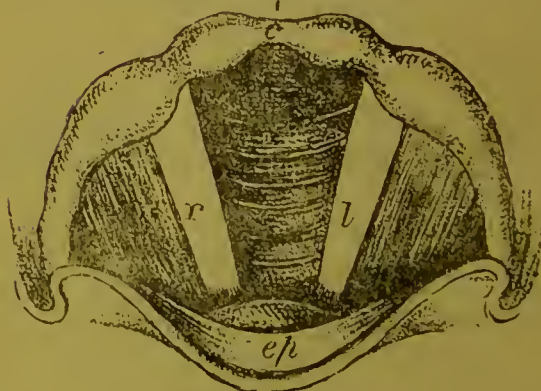
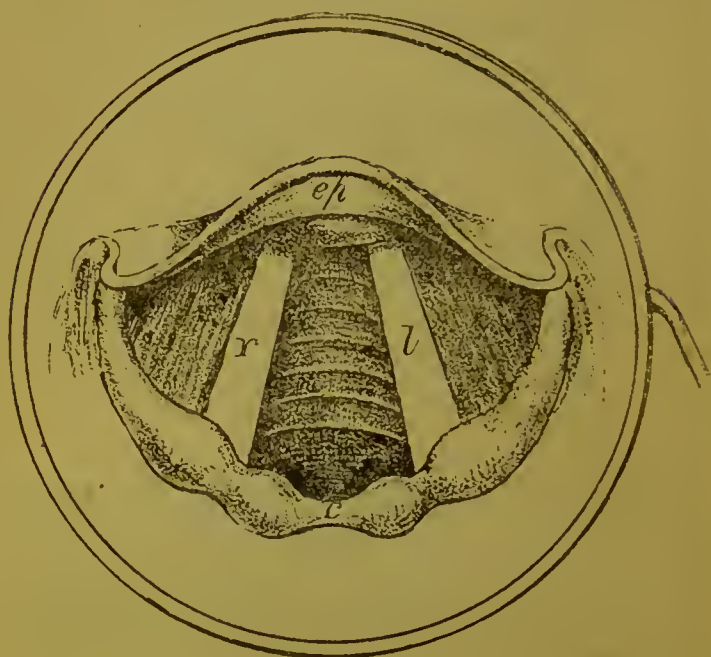


FIG. 27.

VI.

The Laryngeal Image, its Parts.—The Vocal Cords.—The Epiglottis—its Form, its Ligaments, its Surfaces.—The Arytenoid Cartilages.—The Cornicula.—The Cuneiform Cartilages —The False Vocal Cords.—The Ventricles.—The True Vocal Cords.—The Glottis.—The Inter-arytenoid Fold.—The Trachea.—The Bronchi.—The Deviations in Form of the several Parts met with in Disease—from Loss of Substance, from Increase of Size of Parts, from New Growths.—Tracheoscopy.

IN describing the organ of voice as seen in the laryngoscope it is not necessary to enter into the details found in the usual text-books of anatomy. The image at which we gaze in the mirror differs indeed so much from the organ as dissected after death that, although familiarity with its anatomy is necessary for various purposes, the appearance presented during life is of far greater importance. It is then with the laryngeal image we are just now concerned. The theory of the formation of this image has already been explained, and the chief difficulties that may arise in the attempt to examine it have been pointed out. The learner, therefore, who has digested what has preceded is prepared to check by his own experience the description that follows. However confident he may be in his powers of manipulation and his complete

comprehension of the subject, the student will scarcely expect easily to bring into view all the parts of the larynx in every case. His experience will, in fact, be made up of different views, which he mentally unites into one. It is, however, very desirable, especially at first, that he should be able thoroughly to impress on his mind tolerably complete views of the larynx. For this purpose he should, if possible, get a competent teacher to select for him a patient with a well developed larynx, and who is accustomed to the inspection. In this way he will be able to study more leisurely and more thoroughly the healthy larynx than if he begin to examine patients indiscriminately. In some of them he would see but little, and in others possibly nothing at all. To assist him in this practical study I furnish engravings (p. 49) of the healthy laryngeal image. These I have had drawn on an enlarged scale in the hope of rendering the explanations more distinct.

In the first, the vocal cords are open as during quiet respiration—this being the position in which they can most easily be observed. It will be remembered that during expiration and inspiration they will be seen to alternately approach and recede from each other. They are, as previously stated, the most prominent objects after the epiglottis, and, once seen, these two white bands in motion, stretching from the back to the front of the larynx, can never be forgotten.

The epiglottis comes into view before the interior of the larynx, and occupies the highest position in the image. This valve varies very much in form in different individuals ; it is, therefore, said to be long or broad, nar-

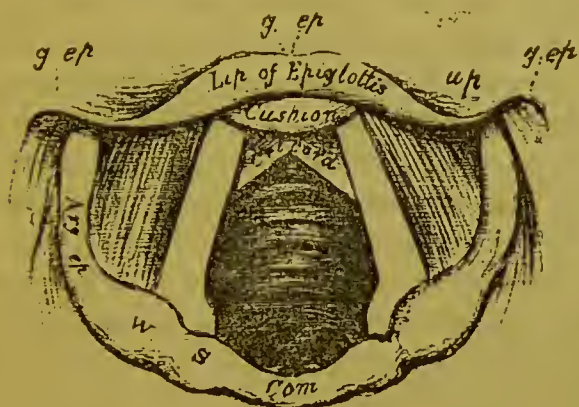


FIG. 28.

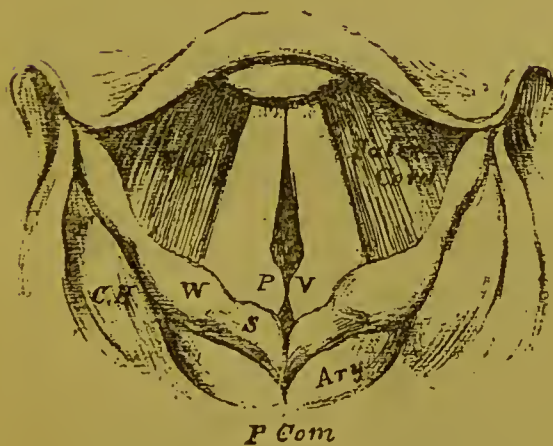


FIG. 29.

row or short, according to circumstances. Not only its actual shape, but its position varies, so that different views appear in the mirror—in one case only its free edge, in another the whole under surface, and in a third the border and part of the upper surface. The beginner must not, therefore, expect always to find the leaf-like body he has read of in his text-book of anatomy. What may be called a fairly-formed natural shape has been shown in preceding figures (21—28, 29), and to these I now add the following illustrations ; but there is no more reason why the epiglottis should be uniform than that noses should be alike.



FIG. 30.



FIG. 31.



FIG. 32.

The free border of the epiglottis will be seen to alternately rise and fall during the examination. The attached border is connected to the receding angle between the two alæ of the thyroid cartilage by a long narrow band, the *thyro-epiglottic* ligament, and a similar band, the *hyo-epiglottic* ligament, connects it with the posterior surface of the body of the hyoid bone. The *lingual, upper or anterior* surface of the epiglottis usually curves forwards towards the tongue, and the mucous membrane by which it is covered forms a median and two lateral folds called *glosso-epiglottidean* ligaments. The *posterior or inferior laryngeal* surface curves in a reverse way. It is usually convex from above downwards, and concave from side to side. To the sides are attached the *glosso-epiglottidean* folds or ligaments (g.-ep.).

The epiglottis, although the most prominent part of the image, is thus necessarily not all visible at once. Moreover, in perhaps only a few cases can even a skilled laryngoscopist easily demonstrate the whole. In most cases a part of the upper surface comes into view on each side, presenting almost a scroll-like form, and in the middle we see the under surface turned up like a lip. Below and behind this another portion seems to bulge out, and has been distinguished as the cushion (Fig. 28). The tinge of colour varies with the part seen. The upper surface is of an obscure pink. The lip looks like what it is, yellow cartilage with a vascular mucous membrane clothing it, and giving a tinge of pink or red. The cushion is much brighter. Further, when we see the whole of the laryngeal surface of the epiglottis at once, the colour is more distinct, and this hue has been taken for conges-

tion by beginners. If only the edge appear in the mirror it looks, from the reflection of the light, like a pale or white line.

The glosso-epiglottic ligaments have been already shown in the Fig. 17 (p. 23), and again in Fig. 21, as also have the outer surface of the aryteno-epiglottidean folds and the inner surface of the wall of the pharynx.

After the cords, the next most striking objects in the view are the prominences composed of the arytenoid cartilages surmounted by the cornicula laryngis.

These arytenoid cartilages are so called from the resemblance they bear, when they are approximated, to the mouth of a cup or ladle (*'απυραίνα*, another form for *'απυρρη*, a word applied to any small vessel for holding water). Their situation is at the back of the larynx, at the upper border of the cricoid cartilage, one on each side. They are therefore right and left; the form of each is somewhat pyramidal. The apex of each pyramid is pointed and curved backwards and inwards. Each apex is also surmounted by a small, conical nodule called the corniculum laryngis or cartilage of Santorini (S, Fig. 28), to which is attached the aryteno-epiglottidean fold.

These parts are more prominent when the vocal cords are closed (Fig 29), and to see them the patient should be made to emit a vowel sound—eh, ah, &c. The mucous membrane is here of a redder hue than in the other portions of the larynx.

In the fold of mucous membrane extending from these bodies to the sides of the epiglottis already spoken of as the aryteno-epiglottidean folds we observe two other elevations called the cuneiform cartilages or cartilages of Wrisberg (W). They are seen in both the open and

closed larynx in front of the prominences just described. The cartilages of Wrisberg vary somewhat in their appearance. Occasionally they seem triangular in shape, their apices pointing outwards; more frequently they appear nearly round. It is obvious that the variations partly depend upon the amount of submucous areolar tissue around them, and partly on the breadth of the folds in which they are located. There are also great differences in the degree to which these cuneiform cartilages are developed. Sometimes they are quite invisible, while occasionally another distinct elevation can be made out between them and the cornicula. These are probably caused by small additional cartilages. The folds in which these prominences appear, aryteno-epiglottidean folds, sometimes contracted to aryteno-epiglottic and even ary-epiglottic, bound the superior opening of the larynx, and can easily be observed in the mirror, extending from the arytenoid bodies upwards and forwards to the sides of the epiglottis. They are usually paler in colour than the prominences mentioned.

Below the aryteno-epiglottic folds (ary-ep., Figs. 28 and 29) two others may be distinguished. These have been called by anatomists the superior or *false* vocal cords, because they do not assist in the formation of the voice. Other names have been proposed for them. Some anatomists speak of them as the superior ligaments of the larynx, but this is not appropriate, for, although a narrow fibrous band is enclosed in each, that has been distinguished as the superior thyro-arytenoid ligament. Another name proposed is ventricular bands (Mackenzie), and a third longer one, regulators of the glottis (Gibb). Names perhaps are of little importance, and we may speak of

them by either ; but to call them the superior ligaments implies that the true cords are the inferior ligaments of the larynx, a name for which no plea can well be put in.

The false cords are thickish and their colour is rather deeper than the folds above them, so that they form sufficiently prominent points in the image, and should always be examined as they are often the seat of disease. Their lower edge borders the ventricle and looks a little paler from the light being fully reflected from it. On the vocal cords coming together there may sometimes be noticed near the epiglottis a little depression between the two sets of folds described. Dr. Morel Mackenzie has proposed for this the name *fõssa innominata*.

We have mentioned the ventricles, or, as they are sometimes called, the sinuses, of the larynx. These are only the spaces between the true and false cords. Each ventricle is described by anatomists as an oblong fossa, bounded above by the free crescentic edge of the false vocal cord ; below by the straight edge of the true cord ; externally by the thyro-arytenoideus muscle. The anterior part of the ventricle leads to a *cul-de-sac* of mucous membrane between the false cord and the inner surface of the thyroid cartilage. This recess or pouch, conical in form, has been compared to a Phrygian cap, and is named the *sacculus laryngis*. Its mucous surface is studded with the openings of sixty or seventy follicular glands which lie in the areolar tissue beneath. The pouch is covered with a fibrinous envelope, and this by muscles, which according to Hilton (*a*), compress the *sacculus*, and

(a) Guy's "Hospital Reports," vol. V.

so discharge its secretion on the vocal cords which are thus lubricated. The openings of the ventricles are only sometimes seen, and then they appear merely as dark lines.

The inferior, or true vocal cords have already been named, but being the most important part deserve a few words more. They are strong and of a fibrous nature, covered by a very thin layer of mucous membrane which is closely adherent to them throughout their length. They are attached posteriorly to the anterior angles of the bases of the arytenoids; anteriorly to a depression between the alæ of the thyroid (*θυρεος*, a shield, *ειδος*) cartilage.

On inspiration the cords separate widely posteriorly, but are near each other anteriorly (Fig. 28). When a sound is emitted they approach each other and meet in the centre, looking like two parallel white bands (Fig. 29), and closing the glottis, as the fissure or chink between them is called. This opening is sometimes barbarously spoken of as the rima glottidis. It is hard enough to have it called the glottis, and to be assured that the word is derived from *γλωττα*, which is only the Attic form of *γλωσσα*, the tongue, on the principle we may suppose that it is not the tongue. But to have the Latin word rima coupled with it, and so the hybrid phrase rima glottidis imposed upon us, is enough to make us protest against the unnecessary word.

Between the arytenoid bodies there is a fold of mucous membrane, the prominence of which depends on the position of the cords. When they are wide open it is very apparent, but when they are closed it folds together. This is called the inter-arytenoid fold, or the posterior commissure (com., Figs. 28 and 29).

So much for the several parts of the laryngeal cavity, but we can see farther still with our mirrors. When the glottis is open it is very common to see some of the rings of the trachea showing through their mucous membrane with great distinctness. This membrane is generally paler than that of the larynx, but this may partly depend on its being less brilliantly illuminated. The rings of the trachea from the reflection of the light often look quite white. Another point we may also bring into view is the cricoid (*κρικος*, a ring, *ειδος*) cartilage (Fig. 28.) Sometimes we can also see the openings of the bronchi.

It is hoped that by the aid of the engravings these descriptions will have been made sufficiently clear, and that the student will find no difficulty in reference to the shape of every part of the healthy larynx. It may be repeated that there are considerable differences of shape within the range of health, and this fact is particularly observable in reference to the epiglottis, though the arytenoids, the commissure, and other parts vary considerably.

The normal form of the several parts of the laryngeal image having been thoroughly impressed on the student's memory he is able to pass to a consideration of the deviations to be met with in disease. Such deviations may obviously be caused in various ways. For instance there may be loss of substance, which is frequently caused by ulceration. Or there may be swelling of some parts, causing a remarkable change of conformation. Again, there may be new growths. From the changes of form thus produced we are often able to pronounce at once an opinion of any case. At the same time there are other circumstances

which should always be taken into account in estimating the diagnosis or prognosis of a case. Here it is only proposed to specify some examples of the deviations of form commonly met with.

I have already illustrated by engravings the fact that the epiglottis varies much in shape, without its variations being the result of disease. Sometimes, however, it is swollen, and completely altered in shape, and this change constitutes an important element in the case. Again, the edge of the lip may become notched like a saw, as the effect of ulceration; or there may be scarcely any of it left, so much loss of substance having occurred from this process. In such cases there is usually deep ulceration elsewhere, with great loss of substance.

Partial swelling is the next mode in which changes of shape are produced. Sometimes there is such enlargement as to quite obliterate the distinctions between the cartilages of Wrisberg, the arytenoids, and the cornicula. This condition is one very commonly met with at a certain stage of phthisis.

It is not necessary to dwell further on the various enlargements now as I shall have occasion to describe them in further detail. Suffice it to say that every deviation of shape, whether the result of loss of substance from ulceration, of swelling from inflammation or infiltration, or of the development of a new growth, is of the very highest importance, and should not be unnoticed.

TRACHEOSCOPY OR INFRA-GLOTTIC LARYNGOSCOPY.

We have already shown that it is often possible to distinguish the rings of the trachea, &c., in the faucial

mirror. It is not to this however that the term tracheoscopy has been applied, but to the exploration of the trachea by means of a small mirror introduced into it through the wound, after a patient has for any purpose undergone the operation of tracheotomy. Neudörfer seems first to have proposed thus to make use of the wound when tracheotomy had been necessitated. Several cases have now been recorded in which the method has been used to examine the trachea and the under surface of the vocal cords. This surface being obviously invisible in ordinary laryngoscopy it has been proposed to call the plan *infra-glottic laryngoscopy*. Common tracheotomy tubes are not adapted for the purpose, but one must be obtained with a long fenestrum. Türk employed a special tube in the trachea for the purpose. A very small mirror is necessary, a steel one is to be preferred as no room is lost by a rim. The most remarkable difference discovered by this method is, that the under surface of the cords instead of being white, like the upper, is of the same red hue as the surrounding mucous membrane. We must remember that in these cases there are mostly changes caused by the disease for which the operation has been performed, besides which the operation itself may have left its trace.

Semeleder has recorded the case of a Medical man who had had tracheotomy performed and was able to practise this method on himself. He suggested a number of improvements in the apparatus, as well as in the canula he was for a long time obliged to wear.

VII.

Demonstration—Various Modes, with patients, with drawings, with models—Auto-Laryngoscopy: several plans of examining and exhibiting one's own larynx.

To teach the art of laryngoscopy the professor may employ various methods—some of which are within the reach of every pupil, and will serve for self-tuition and practice.

Unquestionably, the most efficient, as well as the most interesting plan of instruction, is to demonstrate upon living persons the natural form and colour of the various parts reflected in the laryngoscope, and already described, and to follow this by a series of demonstrations upon patients of the various diseases affecting these parts. For this purpose, however, the professor requires a large clinique, and undoubtedly the student who can avail himself of such instruction will make much more rapid progress than those not within its reach. Still, no one need despair. It is quite possible to acquire the art without an extensive clinique, though it must be much more slowly. The mere manipulation of the instruments will be readily acquired by any one from careful study of what has preceded, though it is much easier to learn from seeing them used.

As only "practice makes perfect," the pupil will naturally feel diffident in his early attempts to examine a patient

for himself. In a large clinique he will find a number of patients who are thoroughly accustomed to the contact of instruments with the throat, and who display the laryngeal image to its full extent without effort. The physician will naturally assign such cases to beginners, who consequently become rapidly familiar with the appearances we have already described, and being told the nature of the cases, do not fall into the errors they otherwise might. They have, therefore, nothing to unlearn.

The beginner may obtain a fair view by looking over the shoulder of the teacher while he is examining a patient for the purpose of diagnosis, and this is the best way to commence the study. It has been objected that the two observers do not see at the same moment exactly the same point, and we may admit that there is some force in the statement, but it is to be remembered that the part to be brought into view is not a mere point, but the image reflected in the whole surface of the mirror—an inch or more in diameter. As a matter of fact, we demonstrate daily in this manner not only the vocal cords in action, but diseases confined to small portions of the larynx, the diagnosis of which is often rendered distinct to those who have never previously seen the laryngoscope in use. A few lessons of this description will therefore save beginners much weary work in uncertainty, besides giving them sufficient confidence to begin to examine patients for themselves, which is the next object to be accomplished. At the Hospital for Diseases of the Throat there is every opportunity of thus learning laryngoscopy, and ample material for studying the practical applications of the art to the diagnosis and treatment of disease.

In the absence of such opportunities of practical instruction the learner will do well to set himself to work with drawings and models, then to practise auto-laryngoscopy, and afterwards to examine with the laryngoscope such of his friends as may be willing to permit it. These plans may be separately discussed. As to drawings, it has been shown in speaking of the theory of laryngoscopy, that the anterior part of the larynx appears at the upper part of the image on the mirror ; while the posterior commissure is at the base, the former thus seeming the nearer, and the latter the more distant from the observer. This, which is the only inversion that really takes place, can be demonstrated by an ordinary toilet mirror inclined at a suitable angle, or what is still better, a laryngoscopic mirror may be used. For this purpose any of the laryngeal images engraved in these pages will suffice. A still better plan is to obtain a well made wax model of the larynx, and practise upon it in the same way.

Another step may be taken when either drawings or models are used, and it is particularly desirable in the latter case. It is for the student, having accustomed himself to see the parts in an ordinary laryngeal mirror by diffused day-light, to darken his room, and to practise with artificial light, just as if his model were a living patient. He may thus become completely master of his light, able to throw it on any point with the utmost facility, while he is learning the usual appearances of the laryngeal image. And he should remember that dexterity is of the first importance in laryngoscopy. Let him also thus practise holding the mirror with each hand, for he must aim at being ambi-dexter. Anatomical specimens

may be carefully examined in the same way, and in all positions, and should these be not accessible, the larynx and trachea of a sheep, calf, or other animal, can always be obtained from the butcher. The anatomy of these parts should be read up at the same time.

All these plans are, however, only preliminary, and the pupil must eventually proceed to examine the living human larynx. He should not trespass upon the good humour of his friends until he has perfect command of his instruments, and is able to feel sure he will not produce any unpleasant tickling. By a little variation in the arrangement of his apparatus he may look at his own larynx in a looking-glass. This practice has been dignified by a distinct name—auto-laryngoscopy. He should become quite *au fait* at it, and we therefore proceed to consider it at length.

Auto-laryngoscopy (αὐτός λάρυγξ σκοπέω) is the art of examining one's own larynx. The pupil should practise it for the sake of acquiring facility in the use of instruments, and also as the best way of studying the anatomy and the physiology of the larynx. The movements brought about in breathing, in sighing, in vocalising, in coughing, in retching, in swallowing, can all be best observed on oneself. Moreover, he who has acquired complete control over his pharyngeal and laryngeal muscles can always demonstrate to others some of the most important facts brought to light by the laryngoscope. There are other reasons why the pupil should aim at being a good auto-laryngoscopist, and we shall therefore proceed to describe the various plans of examining one's own larynx.

The simplest method of all, when sun light is available,

is to sit with the back to the light, so as to allow the rays to fall directly upon a small mirror held in one hand, while with the other, one of my rectangular faucial mirrors is introduced. The engraving (Fig. 33) shows this plan, which was adopted by Garcia, the first person who conceived the idea of studying the movements of the organ of voice in action (*a*).



FIG. 33.

Artificial light may be employed in a similar manner. Another simple mode of illuminating the pharynx was suggested by Czermak, who placed a lamp as near as possible to the open mouth, and so held a small hand-mirror as to protect his eyes from the lamp, and permit him to see in

(*a*) Proceedings of the Royal Society, 1855.

it the image of the glottis reflected from the faucial mirror held in the other hand.

The pharyngoscope of M. Moura-Bourouillou (*a*) may be advantageously substituted for the simple lamp. In this instrument the rays of light pass through a perforation in the reflector, and fall directly on the faucial mirror. This instrument is also useful for other purposes. Those who employ my upright stand (Fig. 10) as a support for the reflector, have only to supplement it with a common hand mirror to obtain the most convenient apparatus for auto-laryngoscopy by reflected light. Seated in the chair, which in simple laryngoscopy is occupied by the patient, the operator finds the lamp by his side, while nearly opposite to him is the reflector. From this the rays of light fall upon his face, and with the hand mirror as a guide, opening his mouth, he easily takes the exact position to bring them to a focus in the fauces, where, with the disengaged hand, he holds the laryngoscope. Another person looking through the perforation in the reflector sees the laryngeal image. Indeed, two or three can see it looking at the side of the reflector, and another person or two standing behind the operator can see the image at which he is looking in the hand-mirror.

An ordinary moderator lamp, with the reflector on stand, a faucial mirror and a hand-glass, thus furnish a simple and efficient apparatus for auto-laryngoscopy and demonstration on any convenient table.

This plan is so easy that I have heard of no difficulties. The engraving (Fig. 34) taken from a photograph, shows a demonstration to one person. It is obvious enough

(a) "Cours complet de Laryngoscopie." Paris, 1861.

that others could also see, but it would be tiresome to photograph several, and the engraver has merely followed the original. On the lamp depicted a condensing lens is fixed, which, of course, increases the brilliancy of the light, as already explained.



FIG. 34.

It may be thought by some that it is fatiguing to hold the hand-mirror steady. For prolonged demonstrations a little mirror can be supported on a jointed rod coming from the stem of the stand. The beginner will, however, not regret the slight fatigue of a little practice by my method,

when he finds that it gives steadiness to his hands, and thus furnishes one of the best exercises in the manipulations he will have to practise. He should therefore hold the looking-glass alternately with the left and right hand, in order to acquire dexterity with each.

It has already been stated that Dr. Walker's globe condenser is furnished with a small plane mirror that makes it available for demonstration. In fact, the addition of a small plane mirror to any apparatus is all that is required.

Dr. Geo. Johnson has proposed another method, which also has the merit of simplicity, but the image is perhaps not quite so sharply defined, as the light which falls on the faucial mirror is reflected from a plane mirror in front of the operator instead of coming directly from the reflector. In his lectures already cited Dr. Johnson thus describes the plan :—

“Sitting at a table of a convenient height, I place a looking-glass at a distance of about eighteen inches in front of me, and a moderator or a gas lamp on one side of the glass, but two or three inches further back, so that the light may not pass directly from the lamp to the mirror. Now, with the reflector on my forehead, I direct the light as it were into the open mouth of my own image in the looking-glass; then, introducing the laryngeal mirror into my own mouth, I see the reflection of my larynx and trachea in the glass before me, and any one looking over my head or shoulder can see the image at the same time. This method therefore serves for autolaryngoscopy and for demonstration; in other words, the experimenter can, by this means, see his own larynx and show it to others.”

“For beginners in the art of laryngoscopy this method affords a very useful means of training and practice. One of the chief difficulties at first is to keep a steady light in the patient's mouth while the laryngeal mirror is being introduced. Now, the student, after arranging his

looking-glass and his lamp, may direct the light from the frontal reflector into his own open mouth in the looking-glass. This process differs scarcely at all from that which he will have to practise on his patients. Then, having learned to keep the light steady, he may practise the introduction of the faucial mirror, and he will soon see the interior of his own larynx and trachea. I have seen several of my Medical friends and pupils succeed in doing all this within less than half an hour of their first attempt.

"It is important to observe that in practising this method of auto-laryngoscopy both eyes may be protected from the glare of the lamp. The lamp is most conveniently placed by the side of the glass to the left of the operator. The right eye is then shaded by the lower margin of the reflector on the forehead, and the left eye may readily be shaded by one or two fingers of the left hand placed at the edge of the reflector. The fingers thus placed serve at once as a shade for the left eye, and a means of moving the reflector when the direction of the light has to be changed. If the experimenter desire to show his larynx to several persons at once, he can readily do this by having the mirror in front of him of small size, about three inches square, and fixed at a convenient height: the small flat mirror belonging to Czermak's auto-laryngoscopic apparatus may be used for this purpose. Thus, while two or three persons standing behind him can see the reflection of his larynx in the glass, two or three others standing in front of him, and looking over the top and by the sides of the glass into his mouth, may see the direct reflection of the larynx from the faucial mirror."

The only other method that need be mentioned here is that of Professor Czermak, which is well adapted for prolonged demonstrations. It requires, however, a special apparatus, and this has been improved by Weiss. It consists of a concave and plane mirror, supported on independent stems about a foot apart, in a manner to permit of motion in all directions, so that each mirror may be easily fixed at the necessary height and at any angle.

The demonstrator sits before the plane mirror, into which he gazes. The concave mirror is about a foot further off, and so placed as to reflect the rays from the lamp into the mouth. The image in the laryngeal mirror can be seen by any one looking through or beside the reflector, and the image at which the demonstrator himself is looking in the plane glass can be seen behind him.

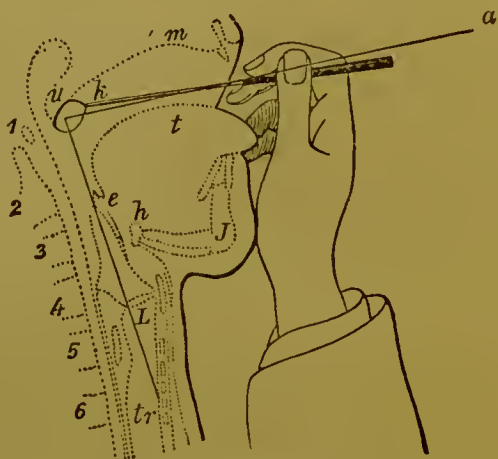


FIG. 35.

1 to 6, the cervical vertebræ; *u*, uvula; *L*, larynx; *e*, epiglottis; *tr*, trachea; *h*, hyoid bone; *t*, tongue; *J*, (lower) jaw; *m*, (upper) maxilla; *k*, laryngoscope.

The theory of auto-laryngoscopy is, of course, the same as that of examining the larynx of another, and the practice consists in mere modifications of the position of the persons and the apparatus. The engraving (Fig. 35) may render the subject a little clearer. The laryngoscope being held *in situ* a ray of light represented as a straight line (*a*), is seen to fall upon it, and be reflected behind the epiglottis (*e*), and so down the larynx (*L*), impinging on the wall of the trachea (*tr*).

VIII.

Exploration of Posterior Nares by Reflected Light or Rhinoscopy—Early Efforts in this Direction—Theory and Practice of Rhinoscopy—Angle of Rhinoscope—Difficulties and Means of Overcoming them: Narrowness of Faucial Aperture, Sensibility, Adhesions, Respiration, Vocalisation, Palate Hooks, Ligatures, &c.—Position of Patient and Physician—The Rhinoscopic Image and its Parts in Health and Disease.—Anterior Rhinoscopy—Auto-Rhinoscopy—Pharyngoscopy and Œsophagoscopy.

IF the faucial mirror be held with its reflecting surface turned upwards, we may obtain a view of the posterior nares. It is this slight deviation from the ordinary procedure that has received the name of rhinoscopy (ῥίν and ῥίς, the nose, σκοπέω).

It is not at all surprising that from an early date attempts had been made to see these parts by the aid of mirrors, and Levret, Beaumès, Bozzini, and other pioneers in the art, appear to have considered it easier to explore the nares than the larynx. In the early days of laryngoscopy, Czermak took up this as a distinct branch of the subject, and the modern practice of rhinoscopy is usually said to date from the appearance of his paper (a). Seme-

(a) Ueber die Inspektion des Cavum Pharyngo-nasale und den Nasenhöhle vermittelst kleiner Spiegel.—*Wien. Med. Woch.*, Aug. 6, 1859.

leder, Voltolini, Stoerk, and others, soon took up the investigation, and their productions are well known to all who have investigated the subject.

The theory involved in the practice of rhinoscopy is exactly the same as that which has already been expounded as regulating laryngoscopy ; the only difference being that the mirror is so held as to reflect the light into another cavity, of which accordingly an image is obtained. There are, however, some variations in practice, and inasmuch as the art of rhinoscopy is more difficult to acquire than that of laryngoscopy, it may be well to set them forth in detail.

In the first place, to explore the posterior nares, it is desirable to select a small mirror—one half an inch in diameter will always be found large enough. Most writers direct the rhinoscopic mirror to be fixed to the stem at a right angle, but this is not essential, for, as already stated, a view of the posterior nares may be obtained by simply turning upwards the face of the ordinary laryngeal mirror. As a rule, it may be found to facilitate the examination to have the angle a little less obtuse than usual for laryngoscopy, but the stem of the mirror may at any time be somewhat bent, in order to change the angle slightly. It is, however, not desirable for the beginner to indulge too much in this practice, as it is apt to render him more ready to blame the shape of his instrument than his own deficient patience. Very great variations are to be obtained by depressing or raising the stem of the mirror. By sufficiently depressing the handle, the face may be made to assume a vertical position, while raising the handle makes it more and more oblique.

Although as long ago as 1859, in the first edition of my treatise on "Sore Throat," I spoke of rhinoscopy as merely turning upwards the face of the ordinary laryngeal mirror, most authors have asserted the necessity of having the rhinoscope fixed at a right angle to its stem. The most recent writer, however, on the subject (Dr. Cohen, of Philadelphia) not only adopts my view, but maintains the superiority of the ordinary laryngoscope for exploring the posterior nares. He says:—

"The same mouth mirror may be used for rhinoscopic as for laryngoscopic examinations, only there is more frequent occasion for the employment of a mirror of smaller diameter. There is no necessity for attaching the mirror to the stem at a right angle, as recommended by some authors, nor is such a mirror as conveniently manipulated as the laryngoscopic mirror.

"If a vertical position of the reflecting surface is desired, it may be obtained very readily by depressing the handle of the mirror. If, on the other hand, it be desired to gain a view of the roof of the nares, or of the vault of the pharynx, the handle can be raised so as to give the mirror a more oblique position. A reflection of the parts, exact as to size and form, such as we obtain of our faces in a toilet mirror, could be obtained only in the absence of necessary structures which prevent our seeing the reflection when the mirror is exactly behind the nares in a vertical plane. It is only an image in perspective of the parts in front of the mirror and above it that can be seen at best, and this we secure with the laryngoscopic mirror in rhinoscopic position much more readily than with the so-called rhinoscopic mirror" (a).

The beginner will probably conclude from this that, as in so many other departments, he must expect success

(a) "Diseases of the Throat." By J. Solis Cohen, M.D., Lecturer College of Physicians of Philadelphia, &c. New York. 1872. P. 70.

rather from his skill in managing his instruments than from the possession of a great variety.

Having selected his mirror, the observer takes his position opposite to the patient, as for laryngoscopy. The greater the space between the posterior wall of the pharynx and the velum the easier will it be to illuminate the nares. When this space is unusually narrow it may be almost impossible to obtain a view of the parts.

The first glance in the mouth not unfrequently reveals the soft palate closely applied to the pharynx instead of hanging freely so as to permit us to pass the mirror behind it. This is caused by the patient breathing through the mouth. He must, therefore, be told to breathe through the nose, when the soft palate falls forwards. Some patients evince great difficulty in maintaining nasal respiration when the mouth is open, but they soon acquire the habit. They may be requested to emit nasal sounds, as suggested by Czermak. At the moment that the current of air is thus sent through the nostrils we may obtain a glimpse of the rhinoscopic image. In obstinate cases the soft palate may be mechanically separated from the pharynx during the examination. For this purpose variously shaped palate-hooks have been made, but they are not often of much use, for they generally give rise to spasm of the muscles, and thus defeat their object. If used at all, the simplest are the best. A broad, flat, or fenestrated hook, held in the left hand, so as just to support the uvula, is the most likely to be tolerated, but it is only by repeated contact that the muscles of the soft palate lose their irritability to such an extent as to make it of real service. The time and patience expended on this

will usually suffice to train the patient to bear the examination without the hook. In extreme cases, and for operative purposes, a ligature has been passed round the uvula to hold it out of the way. The palate has also been held forwards by a couple of tapes passed backwards through the nostrils, brought out of the mouth, and secured by tying in front of the upper lip.

For ordinary diagnostic purposes the most unpromising patient may be taught to tolerate the examination, and in a large proportion of cases even the tongue-depressor may eventually be discarded. In most cases, however, some mode of controlling the tongue will be indispensable—at any rate, at first—and my tongue-depressor will be found the most simple and effectual instrument. (Figs. 13, 14, 15).

Combinations of mirrors and tongue-depressors have been constructed, but will generally be found hindrances; for they really confine the movements of the mirror. The patient can himself easily employ my tongue-depressor, and thus the physician has both his hands free for manipulation.

It only remains to speak of the position of the patient, from which much assistance may be obtained. In speaking of the difficulties of laryngoscopy I pointed out that some of them could be removed by varying the relative position of physician and patient. In rhinoscopy this point is of greater moment. The lamp and other apparatus is managed just as in laryngoscopy, but it is obvious that the variations of position necessitate a little intelligent adaptation of our instruments. The mirror has to be held in such a position as to illuminate the posterior nares. The

rays of light, therefore, must fall upon the mirror in such a manner that they may be reflected upon the parts of which the image is to be seen on its surface. The plane of this surface will form with the plane of the horizon an angle of about 130 degrees. To illuminate the mirror held in that position it will be found that the reflector has to direct the rays to a point rather lower in the fauces than in the practice of laryngoscopy. Hence some advise that the patient should occupy a somewhat lower seat than the physician, and this will frequently be found of great assistance. It is also desirable that the patient should sit quite upright. Indeed, as mentioned by Moura-Bourouillou, he may incline the head slightly forwards, so as to let the uvula fall in the same direction. Some observers, however, advise the patient to be seated on a higher level than the physician, and to incline the head slightly backwards. As a rule, I adopt the erect posture, which is also recommended by Semeleder. In this position a slight inclination can be at once given in either direction. The variety of recommendations only illustrates the fact that a view of the nares may be obtained without an exact adherence to either.

The engraving on the opposite page (Fig. 36), copied from a photograph, shows the position of the parties in the simplest method of rhinoscopy.

Few things are more surprising to beginners than the appearance of the rhinoscopic image which does not in the least resemble that revealed in laryngoscopy and differs materially from the more common preconceptions respecting it.

The parts to which attention is now being directed are

not often examined in the dissecting-room and in ordinary autopsies are never disturbed. This is no doubt the reason why many students have not a very accurate idea of the conformation of the parts, but even those who have carefully worked up the anatomy of this region are often not a little surprised at the image they first see in the rhinoscope.



FIG. 36.

Again, what is called the rhinoscopic image is really the combination of several views, each of which is separately examined by the observer. The mirror is

introduced first on one side and then on the other. In each case it is moved more freely than in laryngoscopy, so as to examine as wide a field as possible and then the two halves—each composed of the several views thus obtained—are blended into one in the observer's mind. It is easy, therefore, to understand that exactness is only to be attained by the utmost care, and all the observer's knowledge and attention are required to appreciate the various views revealed in rhinoscopy and deduce from them correct indications. At the same time, though this is the most common mode of proceeding, there are cases in which a view of a considerable portion of each half may be obtained in the same image.

As it is absolutely necessary for the pupil to thoroughly familiarise himself with the chief points of the rhinoscopic image and to form a fair idea of that image as a whole, he should carefully study the engraving (Fig. 37) before proceeding to the examination of patients.

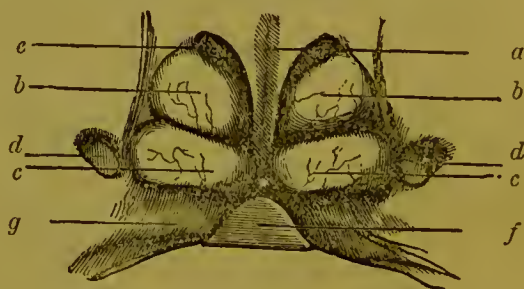


FIG. 37.

a. Posterior border of the septum nasi; *b.* middle turbinated bone; *c.* inferior turbinated bone; *d.* orifice of the Eustachian tubes; *e.* superior turbinated bone; *f.* spatula; *g.* soft palate.

The point which should first be sought is the *septem*

nasi (a) which divides the rhinoscopic image into two halves and one surface of which should be clearly made out on each side. It forms a shining central ridge, narrow below, but increasing in breadth above. At its lowest narrow part, if well illuminated, it may look quite white and bright from the bone shining through the thin mucous membrane. If the light be less brilliant or the membrane not quite so thin and tense the hue may be pale pinkish, or there may be a yellowish tinge. The colour becomes deeper as the septum extends upwards, until at the highest, broadest part it is lost in the red of the mucous membrane of the surrounding parts. It may be added that the septum nasi seldom occupies the exact centre of the image but leans a little to one side or other, so that we seldom see a rhinoscopic image precisely symmetrical.

Having examined the septum, the next point is to make out the *middle* turbinated bones (b). They are easily found, being very prominent points occupying a large portion of the image on each side of the *septum*. They are covered with thin mucous membrane of a pale pinkish hue, and have been mistaken by beginners for nasal polypi. Just below, and much resembling them, at the base of the *fossæ nasi* are two other, somewhat smaller roundish projections, looking like a pair of almost solid tumours. These are the *inferior turbinated bones* (c). They do not seem to approach so near to the *septum* as the middle ones, and moreover look more solid and duller in colour, no doubt partly due to their being less brilliantly illuminated.

Just outside and behind each of the inferior turbinated

bones we may easily discern the irregular openings of the Eustachian tube (*d*). Indeed, many may find it easier to look for the Eustachian orifice first and from that to trace the other parts. These openings look downwards and outwards. From their lower edge running downwards and inwards there is a prominent ridge formed by the levator palati, while from their upper edge starts the fossa of Rosenmüller which extends upwards and inwards and in which not unfrequently the Eustachian catheter gets lodged.

The *superior turbinated bones* (*e*) may be mentioned next. They are not nearly so easy to find with the mirror, in which they are reflected only as narrow projections, in shape somewhat like a triangle with its apex pointing downwards and inwards, and perhaps somewhat backwards.

We have yet to mention the three passages between the turbinated bones. The superior meatus is the largest, but the easiest to discover is the middle one which appears towards the outer wall of the fossa. The inferior meatus is very indistinct, often appearing only as a dark line and to the beginner seldom visible.

Below the nasal fossæ the posterior surface of the uvula, soft palate, pillars, &c., are easily made out, as also is the roof of the palate above studded with glands.

In the practice of rhinoscopy the easiest plan is to pass a small mirror between the uvula and the anterior pillar on one side and carry it gradually behind the uvula towards the median line. It is then to be withdrawn, taken in the other hand and introduced in the same manner on the opposite side. In this way we may often obtain an accurate idea of each portion of the rhinoscopic image and combine the two lateral views into one, when

by a single introduction a much smaller extent of surface could be explored.

In pursuing this method the first point reflected in the mirror is the posterior surface of the uvula, closely following which, or appearing at the same instant, may be traced the posterior surface of the arches and velum, and perhaps one of the teeth.

The mirror should now pass a little higher up behind the velum which is followed by the eye as it spreads itself out until at the upper part it seems to finish in a sort of fleshy ledge, just above and behind which, the septum nasi and nares come into view. A little patience will now enable the observer to make out the several parts that have been described.

Starting then, in what may be called the second stage of his exploration from the septum nasi, the observer should trace this throughout its whole length. On either side of the septum, at the broad, upper part may be discerned the nasal opening. This may be traced downwards to the red fleshy ledge already mentioned as formed by the velum and which intercepts the view of the lowest portion of the opening. The nasal opening having thus been made out we may proceed to trace its outer boundary which will be found to be formed by the projecting outlines of the turbinated bones. The most prominent and easiest to see is the middle which appears at its lower border as if the inferior bone overlapped it. Just above this overlapping or upper part of the inferior bone, at the outer border of the middle turbinated bone, is the middle meatus, and on the outer side of this we come upon the Eustachian orifice.

The reverse order may, of course, be adopted, and some-

times it will be found easier to begin with the Eustachian tube, and trace the other structures between it and the septum. Frequently, the Eustachian orifice is easily discovered by beginners, who find considerable difficulty in obtaining a clear image of the septum and turbinated bones. It is desirable to be able to start from any point, and follow the outline of all the parts as they come successively into view. This will be found possible after a little practice. The general outline of the image must, of course, be familiar to the eye, and then we may begin at any point and pass towards any other without confusion, just as when looking at a map of a locality we know, we glance from one spot to another without losing our consciousness of their relative positions.

It will be seen that a considerable extent of surface can be explored by means of rhinoscopy, for besides the structures already described others much easier to define can be examined and any or all may be the seat of disease.

The use of the rhinoscope enables us not only to see the exact site of the disease and to determine its nature but also to apply local treatment. The rhinoscope is therefore obviously of importance in inflammation, thickening, ulceration, or other affection of any part of the mucous membrane which can be brought into view, while it often at once brings to light polypi or other nasal tumours or demonstrates the cause of long-standing ozæna and enables us to cure this obstinate ailment.

In cases of deafness dependent on disease of the Eustachian tubes the rhinoscope is also sometimes useful, and other illustrations of its value will naturally occur to the reader.

ANTERIOR RHINOSCOPY.

This term has been applied to the examination of the nostrils from the front, which is a very useful supplement to the exploration already described. The patient retaining his position before the observer may be directed to incline his head so far backwards that the light is easily reflected into the nostrils, each of which can thus be examined. If the sides of the nostril be rather close together a probe or any convenient small instrument will easily separate them. If necessary, the nostril may be dilated by a bivalve aural speculum or any of the ordinary nasal dilators, of which Thudichum's is very convenient, as it does not require to be held *in situ*. In placing it the only caution needed is not to introduce it so far as to give rise to unnecessary pain. The instrument is composed of two distinct valves which are connected by a spring. When pressed together the valves form a narrow, oval canal, which can easily be inserted into the nostril, the spring being then allowed gradually to expand. One valve is shorter than the other and should be placed on the side of the septum so that a dilator is required for each nostril; it is further convenient to be furnished with several sizes. The instrument "is designed exclusively to expand the atrium or membrano-cartilaginous part of the nostril; if it were allowed to enter beyond this, and to reach the isthmus formed by the unyielding cartilaginous septum and the nasal margin of the ascending branch of the upper maxillary bone, it would cause pain, and narrow by its own

thickness this small passage" (a). To this it is only necessary to add that it is sometimes needful by pressure to reduce the power of the spring to a minimum, and occasionally the parts are so tender that this dilator cannot be employed at all. To meet such cases Messrs. Maw have made a dilator on the principle of the eyelid retractor (fig. 38), in which, by means of the screw, the degree of dilation can be exactly graduated.

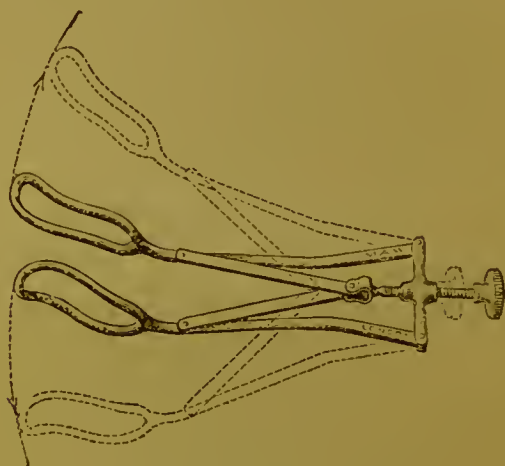


Fig. 38.

AUTO-RHINOSCOPY.

This term is used sometimes for the self demonstration of the parts described in the same manner as auto-laryngoscopy in reference to the larynx.

(a) "Polypus in the Nose." By John W. Thudichum, M.D. 1869.

PHARYNGOSCOPY AND ŒSOPHAGOSCOPY.

In speaking of rhinoscopy I showed that part of the pharynx can be very carefully explored and some have proposed to give this a distinct name, though we might almost as well apply it to the simple inspection of the fauces. If, however, we turn our attention to the upper portion of the alimentary canal we find it is not so easy to examine as is the air-tube. The pharynx, indeed, is easily explored. Its posterior wall can always be seen without a mirror, and with one the vault, &c., is easily brought into view. But turning our attention downwards we are arrested,

Many efforts have been made to overcome the obstacles offered to the exploration of the œsophagus by reflected light. The walls of this tube fall together, instead of remaining open like the larynx and trachea. Hence, it is necessary to have some mode of separating the walls at the same time that the light is directed along them. Semeleder has, perhaps, done more in this direction than any one, and by practising upon himself has demonstrated to others a portion of the tube. One inch or two may, with perseverance, be revealed, but the operation is very trying and seems more likely to be practised for curiosity than with the hope of its becoming of any great clinical use. It is no easy matter to tolerate a tube in the position required, much less the movement of such a tube, so as to expose successive portions of the membrane. Happily, the œsophagus can be explored by other methods.

IX.

*History of Laryngoscopy.—Early Efforts of the Author.—
Laryngoscopical Therapeutics. — Horace Green. —
Czermak.—Türk.—Garcia's Prior Discovery.—His
Paper.*

THE history of the laryngoscope closely resembles that of many other inventions. We find that several persons at various intervals were intent on the endeavour to obtain a view of the interior of the larynx during life. Some, indeed, seem to have actually seen the glottis, others, without clearly defining them, discerned in a mirror parts otherwise invisible, and all succeeded more or less, according to the patience they brought to bear on the problem, and the methods and instruments they employed. Thus it is that several persons only just missed being recognised as the inventors of the laryngoscope, and when at length the instrument was perfected and its value demonstrated, more than one claimed a share in the honour of discovering so great an addition to our means of investigating and treating disease.

In what we may call the pre-laryngoscopic era, I had been much interested in diseases of the respiratory

organs, and in one case had succeeded, as recorded in my work on "Sore Throat," in bringing into view and curing disease by the aid of reflected light. This established the principle of the laryngoscope; but at that period I had not the opportunity of following up the subject, nor do I profess to have foreseen its importance. The instruments I had constructed for an individual case were laid aside without any effort to improve them, so as to render them of daily use. This case was treated by me in 1856, and was recorded in the first edition of my work, which, though written in the interval, was not published till the end of 1859. In fact, on the announcement of the brilliant results obtained in Vienna by the very plan I had employed, the issue of the work was naturally delayed, in order to include in it an account of the subject.

It will be seen in the sequel that I put forward no claim to priority; though being, at that time, unaware of what others had accomplished, I may feel justified in accepting the credit that is usually accorded to originality. Moreover, though anticipated by others in the use of reflected light for the purpose of diagnosis, it is not disputed that I was the first person to apply topical remedies by the aid of the faucial mirror. The development of laryngoscopy has since been such that any one may well feel gratified at having taken a part in it at the very commencement; and here I cannot miss the opportunity of expressing once more my admiration of the late Dr. Horace Green, of New York, who had anticipated laryngoscopy by working without the mirrors at all. In truth, I had only used

mirrors to enable me to see what I was doing when attempting to carry out local treatment, as recommended by him (a). This much premised, I continue the history as it presented itself to my own observation.

In 1858 Czerniak's first announcement was made in the *Wiener Mediz. Wochenschrift*, immediately after which he submitted to the Vienna Academy of Science an account of his experiments in a paper entitled "Physiological Researches with Garcia's Laryngoscope" (*Physiologische Untersuchungen mit Garcia's Kehlkopfspiegel*).

The title of this paper is very striking. Czerniak here calls the instrument with which his first experiments were made, *Garcia's laryngoscope or larynx-mirror*. He had, as we know from his own statement, borrowed Garcia's instrument from Professor Türk, who had previously attempted to utilise it for diagnosis in the wards of the General Hospital at Vienna.

Garcia, an able professor of singing still living, had used his mirror to investigate the physiology of the voice, and that so successfully that he had four years previously described to the Royal Society of London the appearances presented by the human larynx during life, as determined by experiments made on himself. He had, in fact, discovered and applied the art of auto-laryngoscopy. Nay, more, we are now told by Dr. Mandl (b) that in sending him a copy of his paper, Garcia had urged upon him to apply his method to the investigation of diseases of the larynx.

(a) "A Treatise on Diseases of the Air Passages." By Horace Green, M.D. New York, 1849.

(b) "Traité Pratique des Maladies du Pharynx et du Larynx." Paris, 1872.

This paper of Garcia's was read at the Royal Society, and printed in the "Proceedings." Notices of it appeared in the continental papers, and attracted the attention of Professor Türck, who set to work to test the method. He does not seem to have been very successful, and this need not surprise us when we learn that he confined his efforts to the use of direct sunlight which, even in Vienna, is not always at the service of experimenters. Czermak soon found out the value of the mirrors Türck had lent him, and set to work to improve the method. He rendered himself independent of the weather by using artificial light, and he availed himself of the ophthalmoscopic mirror to bring the rays to a focus on the laryngoscope. Following up the discovery with the utmost enthusiasm, he perfected the apparatus, drew the attention of the Medical world to the extensive field of research thus opened, and received in all directions the credit of being the discoverer of the laryngoscope. It is clear, however, that he was much indebted to others. But for Türck he might never have heard of Garcia's laryngoscope. While, therefore, we accord to Czermak the highest praise for his indefatigable efforts to popularise the method, and for the many improvements he effected in it, it is impossible to ignore the immense services that Garcia has rendered to our art, or to deny him the honour of priority in the discovery.

Garcia did not merely make a suggestion and leave others to test it. He completed the discovery of autolaryngoscopy, and further, by means of that, he described to the most critical scientific body in the world the physiology of the human voice as demonstrated by his

method. In the light of all that has since been done, the accuracy of the descriptions first recorded by this ingenious and scientific professor of singing is most remarkable. His paper would have done credit to expert anatomists and physiologists, and reading it now one cannot but wonder that the Royal Society did not confer some signal reward on the accomplished author.

The historical interest of this paper is such that, as it is somewhat inaccessible, I here reprint it in full from the "Proceedings of the Society."

"Observations on the Human Voice." By MANUEL GARCIA, Esq. Communicated by Dr. SHARPEY, Sec. R. S. Received March 22, 1855 (a).

The pages which follow are intended to describe some observations made on the interior of the larynx during the act of singing. The method which I have adopted is very simple. It consists in placing a little mirror, fixed on a long handle suitably bent, in the throat of the person experimented on against the soft palate and uvula. The party ought to turn himself towards the sun, so that the luminous rays falling on the little mirror, may be reflected on the larynx. If the observer experiment on himself, he ought, by means of a second mirror, to receive the rays of the sun, and direct them on the mirror, which is placed against the uvula. We shall now add our own deductions from the observations which the image reflected by the mirror has afforded us.

Opening of the Glottis.

At the moment when the person draws a deep breath, the epiglottis being raised, we are able to see the following series of movements:—The arytenoid cartilages become separated by a very free lateral movement; the

(a) "Proceedings of the Royal Society of London," Vol. VII., 1856. Meeting of May 24, 1855. Page 399 to 410.

superior ligaments are placed against the ventricles; the inferior ligaments are also drawn back, though in a less degree, into the same cavities; and the glottis, large and wide open, is exhibited so as to show in part the rings of the trachea. But unfortunately, however dexterous we may be in disposing these organs, and even when we are most successful, at least the third part of the anterior of the glottis remains concealed by the epiglottis.

Movement of the Glottis.

As soon as we prepare to produce a sound, the arytenoid cartilages approach each other, and press together by their interior surfaces, and by the anterior apophyses, without leaving any space, or intercartilaginous glottis; sometimes even they come in contact so closely as to cross each other by the tubercles of Santorini. To this movement of the anterior apophyses, that of the ligaments of the glottis corresponds, which detach themselves from the ventricles, come in contact with different degrees of energy, and show themselves at the bottom of the larynx under the form of an ellipse of a yellowish colour. The superior ligaments, together with the aryteno-epiglottidean folds, assist to form the tube which surmounts the glottis; and being the lower and free extremity of that tube, enframe the ellipse, the surface of which they enlarge or diminish according as they enter more or less into the ventricles. These last scarcely retain a trace of their opening. By anticipation, we might say of these cavities, that, as will afterwards appear clearly enough in these pages, they only afford to the two pairs of ligaments a space in which they may easily arrange themselves. When the aryteno-epiglottidean folds contract, they lower the epiglottis, and make the superior orifice of the larynx considerably narrower.

The meeting of the lips of the glottis, naturally proceeding from the front towards the back, if this movement is well managed, it will allow, between the apophyses, of the formation of a triangular space, or intercartilaginous glottis, but one which, however, is closed as soon as the sounds are produced.

After some essays, we perceive that this internal disposition of the larynx is only visible when the epiglottis

remains raised. But neither all the registers of the voice, nor all the degrees of intensity, are equally fitted for its taking this position. We soon discover that the brilliant and powerful sounds of the chest-register contract the cavity of the larynx, and close still more its orifice; and, on the contrary, that veiled notes, and notes of moderate power, open both so as to render any observation easy. The falsetto register especially possesses this prerogative, as well as the first notes of the head-voice (a). So as to

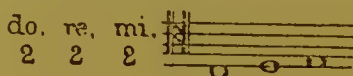
Table of the Human Voice in its full extent.



render these facts more precise, we will study in the voice of the tenor the ascending progression of the chest-register, and in the soprano that of the falsetto and head-registers.

Emission of the Chest-voice.

If we emit veiled and feeble sounds, the larynx opens at the notes



†; and we

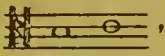
see the glottis agitated by large and loose vibrations throughout its entire extent. Its lips comprehend in their length the anterior apophyses of the arytenoid cartilages and the vocal cords; but, I repeat it, there remains no triangular space.

As the sounds ascend, the apophyses, which are slightly rounded on their internal side, by a gradual apposition

(a) Let us here observe that three registers of voice are generally admitted,—chest, falsetto, and head. The first begins lower in a man's voice than in a woman's; the second extends equally in both voices; the third reaches higher in the female voice.

(b) The musical limits we establish in the course of these pages vary a little in each individual.

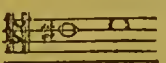
commencing at the back, encroach on the length of the glottis ; and as soon as we reach the sounds

si. do.  , they finish by touching each

other throughout their whole extent ; but their summits are only solidly fixed one against the other at the

notes do. ré,  . In some organs these

summits are a little vacillating when they form the posterior end of the glottis, and the two or three half-tones which are formed show a certain want of purity and strength, which is very well known to singers. From

the do. ré,  the vibrations, having become

rounder and purer, are accomplished by the vocal ligaments alone, up to the end of the register.

The glottis at this moment presents the aspect of a line slightly swelled towards its middle, the length of which diminishes still more as the voice ascends. We also see that the cavity of the larynx has become very small, and that the superior ligaments have contracted the extent of the ellipse to less than one-half.

When instead of veiled and feeble sounds, we make use of full and vibrating ones, the glottis becomes visible

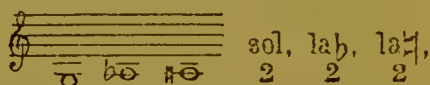
only at the sounds mi. fa,  , and those

above them, a limit which depends to a certain extent on the dexterity of the singer. For all the rest, the organs act as we have just said, but with a double difference : 1. The cavity of the larynx contracts itself more when the voice is intense, than when it is feeble ; 2. The superior ligaments are contracted so as to reduce the small diameter of the ellipse to a width of two or three lines. But, however powerful these contractions may be,

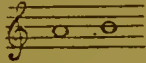
neither the cartilages of Wrisberg, nor the superior ligaments themselves, ever close sufficiently to prevent the passage of the air, or even to render it difficult. This fact, which is verified also with regard to the falsetto and head-registers, suffices to prove that the superior ligaments do not fill a generative part in the formation of the voice. We may draw the same conclusion by considering the position occupied by the somewhat feeble muscles which correspond to these ligaments; they cover externally the extremity of the diverging fibres of the thyro-arytenoid muscles, and take part especially in the contractions of the cavity of the larynx during the formation of the high notes of the chest and of the head-registers.

Production of the Falsetto.

The low notes of the falsetto,



show the glottis infinitely better than the unisons of the chest-voice, and produce vibrations more extended and more distinct. Its vibrating sides, formed by the anterior apophyses of the arytenoid cartilages, and by the ligaments, become gradually shorter as the voice ascends;

at the notes la , si , , the apophyses take

part only at their summits; and in these notes there results a weakness similar to that which we have remarked in the chest-notes an octave below. At the

notes do^\sharp , ré , , the ligaments alone

continue to act; then begins the series of notes called *head-voice*. The moment in which the action of the apophyses ceases, exhibits in the female voice a very sensible difference at once to the ear and in the organ itself. Lastly, we verify that, up to the highest sounds-

of the register, the glottis continues to diminish in length and in width.

If we compare the two registers in these movements, we shall find some analogies in them: the sides of the glottis, formed at first by the apophyses and the ligaments, become shorter by degrees, and end by consisting only of the ligaments. The chest-register is divided into two parts, corresponding to these two states of the glottis. The register of falsetto-head presents a complete similarity, and in a still more striking manner.

On other points, on the contrary, these same registers are very unlike. The length of the glottis necessary to form a falsetto note, always exceeds that which produces the unison of the chest. The movements which agitate the sides of the glottis are also augmented, and keep the vibrating orifice continually half opened, which naturally produces a great waste of air. A last trait of difference, is in the increased extent of that elliptic surface.

All these circumstances, which we shall refer to again, show in the mechanism of the falsetto a state of relaxation, which we do not find in the same degree in the chest-register.

Manner in which the sounds are formed.

As we have just said, and what we have seen proves it, the inferior ligaments, at the bottom of the larynx, form exclusively the voice, whatever may be its register or its intensity; for they alone vibrate at the bottom of the larynx (*a*). But by virtue of what principle is the voice formed? It seems to me that the answer to this question can be but this: the voice is formed in one unique manner,—by the compressions and expansions of the air, or the successive and regular explosions which it produces in passing through the glottis.

The ligaments of the glottis are situate about the mean level of the upper border of the cricoid, close the passage, and present a resistance to the air. As soon as the air

(*a*) We gladly acknowledge that this most important fact has been already announced by J. Müller, although we have our objections to the theory which accompanies it.—*Handbuch der Physiologie des Menschen*.

has accumulated sufficiently, it parts these folds and produces an explosion. But at the same instant, by virtue of their elasticity, and the pressure from below being relieved, they meet again to give rise to a fresh explosion. A series of these compressions and expansions, or of explosions, occasioned by the expansive force of the air and the reaction of the glottis, produces the voice.

This theory, though now generally admitted for reeds, and undoubtedly evident in the liquid vein, the toothed-wheel of Savart, the syrène of the Baron Cagnard Latour, &c., has not to my knowledge been yet applied to the glottis (a). If we consider that the lips of this aperture, taken separately, can give no kind of sound, however we may try to make them speak, we must admit that the sounds which they give forth by their mutual action, are only owing to the explosions of the air produced by their strokes (b). It is not necessary, in order to obtain the explosion of sound, that the glottis should be perfectly closed each time after its opening; it suffices that it should oppose an obstacle to the air capable of developing its elasticity. In this case the rushing of the air is heard accompanying the sounds, and they take a veiled, and sometimes an extremely muffled character—an observation which we have already presented to the reader's notice in speaking of the falsetto.

Conjectures on the Formation of the different Registers.

As the entire system of vibrations arises solely from the inferior ligaments, it is evident that the cause of the different tones called registers, must be sought for in the muscles which set these ligaments in motion; and that

(a) I find that Dr. Müller hints at the possibility of the voice being thus formed, but only to attack and reject the notion.—*Ibidem*.

(b) Many controversies have arisen respecting the sounds sometimes emitted by animals after the section of the superior and recurrent laryngeal nerves; sounds which have been perhaps occasioned by the struggling of the animal causing a swelling of the neck and a mechanical contact of the vocal ligaments. However, without doubt, after the section of these nerves, voice, as a voluntary act, can no longer take place.

the other parts of the larynx must be considered only as apparatus for strengthening the sounds obtained, and for modifying their quality. In our efforts to discover the more intimate processes of the vocal organs which produce the sounds, we shall recur at once to the observations already mentioned, to some anatomical remarks which we are going to make, and to the sensations which we feel in the organ itself whilst it is producing sounds.

If we detach one of the halves of the thyroid cartilage, we shall see a large muscular surface of oblique fibres, which fills all the space between the arytenoid and thyroid cartilages. At its upper end is to be seen the muscle corresponding to the superior vocal ligaments, and which sometimes extends to the notch in the thyroid. After detaching this generally frail muscle, all the fibres constituting this muscular surface seem to start from two opposite centres, viz., the anterior surface of the arytenoid, and the re-entering angle of the thyroid. These centres, occupying the extremities of a diagonal line, send their fibres towards each other in parallel lines. Those which start from the anterior face of the arytenoid descend obliquely; the most external ones go to the cricoid, whose posterior half they cover at the side; the most internal ones descend to the vocal membrane (*a*), which they cover entirely. The fibres which terminate at the membrane become longer, as they become more internal. Those which start from the re-entering angle of the thyroid re-ascend obliquely to the summit of the arytenoid, then diverge in order to form the sides of the ventricles, and then disappear in the aryteno-epiglottidean folds, and even the under surface of the epiglottis. If we cut it away in successive layers, proceeding *from* the outside *to* the in, we reach a thick bundle of fibres, perfectly horizontal, which line the outer aspect of the vocal ligament, and which go from the anterior apophyses of the arytenoid to the re-entering angle of the thyroid (*b*).

This bundle has its posterior half covered by the lateral crico-arytenoid muscle, and its anterior half by the diverg-

(*a*) We thus designate that part of the membrane which goes from the bottom of the vocal ligament to the edge of the cricoid.

(*b*) Another portion of the thyro-arytenoid muscle.

ing fibres which start from the thyroid. If we cut away the horizontal bundle in successive layers, we see that the fibres are not all of the same length; the most external fibres are the longest, and the succeeding ones get gradually shorter as they become more internal; but they all originate in the anterior cavity of the arytenoid, and the muscle is inserted in the manner above explained throughout the whole length of the vocal ligaments, the thyro-arytenoid portion of it excepted. As the fibres all begin from the arytenoid, and terminate successively at more distant points of the membrane, we see that the muscle is thicker behind than before.

Thus the vocal ligament, and the membrane which depends from it, the sole sources of all vocal sounds, are under the direct action of the fibres which come from the anterior cavity of the arytenoid; the ligament under the action of the horizontal bundle, the membrane under that of the oblique fibres. The long horizontal fibres, extending from one cartilage to the other, are placed at the exterior of the short horizontal fibres, and at the interior of the oblique fibres. The diverging fibres which start from the thyroid, acting only on the superior vocal ligaments and the folds, seem to influence by their contractions only the quality and volume of the voice.

The remarkable arrangement of the fibres which we have just examined, enables us to explain a fundamental fact,—the elevation of the voice. The fibres of the horizontal bundle being placed over each other, in layers, one covering the other, and getting gradually longer and longer, as they become more external, extend their action to the more anterior parts of the edges of the glottis. This progressive action from the back to the front, encroaches gradually on the length of the vibrating portion of the ligament, and likewise increases its tension, and its faculty of accelerating its pulsations.

Another portion of the thyro-arytenoid muscle at the same time stretches and raises the vocal membrane more and more, causing a lesser depth of the ligaments to be in contact, in proportion as the sounds become higher, and thus assists by increasing the mobility of the ligaments.

We shall see in a few moments that the rotatory move-

ment, which the external fibres of the lateral crico-arytenoid muscles give to the arytenoid, by making the vocal membrane deeper, partly counteracts the above effect, and produces the chest-register.

The crico-thyroid muscle, on the contrary, is a powerful auxiliary in the elevation of the voice. This muscle, which at the same time causes the thyroid to come forwards and downwards, gives rise to a mechanical tension, not only in the vocal ligament, but even in the whole vocal membrane. The meeting of the thyroid and cricoid cartilages, which we can feel by the touch, becomes especially marked when the inter-ligamentous glottis alone produces the sounds, which takes place as we have seen

at the notes *do*[♯], *ré*,  in the chest-register,

and an octave above for that of the head; with this difference, however, that for the latter a more vigorous and complete connexion is necessary.

Let us now see what we may learn from the sensations we feel in the vocal organ. When we produce a chest-note, the least attention enables us to distinguish a "pinching" at the posterior part of the glottis, which becomes more vigorous as the notes ascend. This pinching seems to be formed by extension of the depth of the touching surfaces, and may become very painful; whilst the notes of falsetto, when higher than chest ones, give comparatively great relief to this part, and the surfaces in contact seem to have become thinner.

If we combine these sensations with the different remarks which have been furnished to us by the examination of the muscles, we can fix the particular mechanism of each register.

Chest-Register.

In fact, when the arytenoid muscles have brought in contact the arytenoid cartilages, and closed the glottis, the voice may take two very different characters; nay, more, it will be produced in pitches widely apart from one another, and will give forth the chest, or falsetto registers, according as the fibres of the thyro-arytenoid attached to

the vocal membrane are active or not. By the action of these fibres, as we have seen, this muscle raises the vocal membrane, and makes its appposable part thinner; whereas the lateral crico-arytenoid gives a rotatory movement to the cartilage, which brings the apophyses into deep contact. This deep contact, which continues even after the apophyses no longer partake in the vibrations, gives a deep tension to the membranes, increases the depth of their contact (*a*), and, as a necessary consequence, augments the resistance they present to the air. It is to the extent of this resistance that we attribute the formation of the chest-register, so distinct by its particular amplitude. To it we attribute also the slowness of the beats of the glottis, and the consequent low pitch of the sounds—a pitch which, even in the highest tenor voices, is at least an octave lower than the head notes of ordinary sopranis.

Register of Falsetto.

When, on the contrary, the external fibres of the lateral crico-arytenoid muscle remain inactive, we produce the falsetto. The lips of the glottis, stretched by the horizontal bundle of the thyro-arytenoid, come in contact by their edge alone, formed at once by the ligament and the apophyses, and offer little resistance to the air. Hence arises the great loss of this agent, and the general weakness of the sounds produced here.

But as soon as we reach the sound *do*,⁴ the beats are produced by the ligaments exclusively, and we have attained the head-register. It is certain, as we may deduce from the movement of the ligaments, that then the vocal membrane is raised by the action of the fibres of the thyro-arytenoid muscle, and its surface is diminished to an edge; but we think that the external fibres of the lateral crico-arytenoid, which would prevent this movement, remain inactive. Then also the very decided tension, which the crico-thyroid muscle effects on the vocal tendons, and which accelerates their movements, takes place.

(*a*) It is then that we feel the pinching of which we have spoken.

During the chest-register, therefore, the vocal ligaments are stretched, and are in contact to an extent corresponding with the depth of the anterior apophyses of the arytenoid, whilst in the falsetto the edges alone of the ligaments are stretched and apposed; in both cases the sounds being formed, not by the actual vibrations of either the whole or part of the tendons, but by the successive explosions which they allow.

Pressure of the Air.

Until now, in our remarks on the manner in which the voice is formed, we have only referred to the rigidity of the glottis, a rigidity necessary to accomplish the 1,056 vibrations in one second (*a*), which form the *do*⁴ of the chest-voice, and to accomplish the double number which produces the octave above in the head-voice. There is, notwithstanding, another indispensable element for the production of vocal sounds, the pressure of the air. Pressure, as is well known, developes an elastic force in this agent, in a degree inverse to the volume which it occupies. It is by means of this power that the intensity of the sounds is obtained. The intensity of the sound can only depend on the quantity of air which goes to each *sharp* explosion. I say *sharp* explosion, as an express condition: the glottis should close itself perfectly after every vibration; for if the air found a constant passage, as in the notes of falsetto, then the greatest movements of the glottis and the greatest waste of air would produce precisely the weakest notes. To reject this theory would be to attribute the intensity of the sound to the extent of the vibrations accomplished by the lips of the glottis, and to suppose that these lips, each taken separately, possess the power of producing sounds, suppositions quite contrary to the facts.

The elastic force of the air arises not only from the compression of the lungs, but also from the contractions of the trachea, which adjusts its calibre to the different dimensions of the glottis. It is by means of this force

(*a*) Pouillet, *Physique*, Sixth Edition, vol. ii., page 77.

that the air conquers the continually-increasing obstacle presented by the lips of the glottis when they produce sounds more and more intense.

Thus the problem of the elevation of the voice, always complicated with that of its intensity, in order to be complete, ought to show the connexion which exists between the tension of the lips of the glottis, the pressure of the air, and the number and intensity of the explosions obtained. As a consequence, we may state that the greater pressure of air necessary to produce the greater intensity, would at the same time increase the number of pulsations, and so raise the tone ; but to prevent this, the glottis must at the same time be lengthened, and *vice versâ* ; or, in other words, that the different lengths of the glottis can, under different degrees of pressure, produce the same number of shocks, but at different degrees of intensity.

Of the Qualities of the Voice.

Various simultaneous causes modify the qualities of the voice :—1. According as the glottis partially or entirely closes the passage between the explosions, it produces veiled or brilliant sounds ; 2. The tube which surmounts and surrounds it also greatly affects the quality of the voice ; by its contractions it gives brilliancy to it and its widening volume ; 3. The epiglottis also plays a very important part, for every time that it lowers itself, and nearly closes the orifice of the larynx, the voice gains in brilliancy ; and when, on the other hand, it is drawn up, the voice immediately becomes veiled.

X.

Czermak. Türck. Liston. Avery. Bozzini. Levret. Senn. Baumés. Cagniard de Latour. Warden. Babington. Bennati. Trousseau and Belloc. Selligue. Recent writers.

WE have seen that Garcia's paper was known to Türck, who had endeavoured to utilise the discovery, and that from the latter Czermak first heard of the method of exploring the larynx. It is to be regretted that a dispute as to priority should have arisen between Türck and Czermak, especially considering what others had done. Czermak so improved the laryngoscope as to make it far more easy to use. He substituted the concave mirror for the plane one used by Garcia, taking the idea from the ophthalmoscope, as I had already done.

He illustrated the value of the instrument by public auto-laryngoscopic demonstrations, and travelled to Paris and then to London for the purpose of thus stimulating others to occupy themselves with the subject. Moreover, he extended the use of the method to the exploration of the posterior nares, and thus originated the art of rhinoscopy, while the cases he related sufficed to prove the

clinical value of the method. It is impossible to over-estimate the influence this enthusiasm had in rapidly diffusing a knowledge of the value of laryngoscopy throughout the Medical world, nor can we deny that but for him the art might once more have been forgotten. Still we must not forget the claims of others.

Türk seems to have been roused by Czermak's success to new efforts. He at once put in his claim to priority—a claim as to which there can be no question, and he henceforth worked constantly at the subject. The result was, that he produced the most elaborate and complete work on the subject, in which he recorded numerous cases, and depicted the laryngoscopic appearances. His "*Klinik*" and the accompanying "*Atlas*" of coloured plates remain as monuments of the skill and industry with which he followed up the art of laryngoscopy in all its ramifications.

In his earliest papers Czermak spoke of the laryngoscope as Garcia's. Later he seems to have discovered that Liston had proposed to use a dentist's mirror dipped in warm water to explore the glottis (*a*), and accordingly spoke of the "principle of Liston and Garcia's method of inspecting the larynx." Liston had said this when writing of swellings that obstruct the larynx, and even then seemed to rely more on the touch (*b*), so that it is doubtful how far that skilful surgeon expected to see.

Subsequent writers have found that both before and

(*a*) "*Practical Surgery*," 3rd Ed. 1840.

(*b*) The passage is as follows:—

"The existence of this swelling may often be ascertained by a careful examination with the fingers, and a view of the parts may sometimes be obtained by means of a speculum—such a glass as is used by dentists on a long stalk, previously dipped in hot water, introduced with its reflecting surface downwards, and carried well into the fauces."

after Liston many others had similar ideas, and even seem to have come much nearer to the discovery, some, as already mentioned, scarcely escaping it.

Thus Mr. Avery seems, about 1844, to have invented an instrument which may be called a laryngoscope, inasmuch as he fixed a mirror to a speculum and adapted a lamp to it. Mr. Avery seems to have applied himself with considerable success to the exploration of the passages of the body, and amongst them of the larynx. Being himself possessed of great mechanical skill, he constructed his own instruments, which were much admired at the time, but a description of them was not published until a later date, when the late Mr. Yearsley called attention to his claims (*a*).

But Avery's lamp was scarcely new, for at the beginning of the century Bozzini had incurred considerable odium by an invention of the same kind, with which he claimed to be able to see the interior of the passages of the body. Nay, long back in the former century—before its middle—in 1743, French authors claim for their celebrated accoucheur and inventor, Levret, that he had applied the principle of the laryngoscope by the mirror he used in connection with a speculum of his own invention in applying ligatures to polypi behind the velum.

It is not improbable that earlier citations will yet be made, but it is clear that these men only foreshadowed as others did, what was to be achieved.

Senn and Baumés both used faucial mirrors, as did several others.

Cagniard de Latour employed a second mirror to

(*a*) *Medical Circular*, vol. xx., 1862.

direct (*a*) the light, and thus seems to have nearly anticipated Garcia, for that was in 1825, in seeing the vocal cords. He failed to see the glottis, but had he tried on several persons he would assuredly have accomplished his object.

It was after this that Dr. Warden, of Edinburgh (1844), endeavoured to illuminate the larynx by means of prisms.

As early as 1829 a distinguished English physician, the elder Babington, had publicly exhibited an instrument which he called a "glottiscope," and in which the principle of laryngoscopy was clearly exemplified. So many claims to priority have been put forward, that it will perhaps interest the reader to peruse the terms in which Dr. Babington's discovery were recorded at the time. I therefore extract the following passage from the *London Medical Gazette* of that year:—

HUNTERIAN SOCIETY.

March 18, 1829.

DR. BILLING, President, in the Chair.

DR. BENJAMIN BABINGTON submitted to the meeting an ingenious instrument for the examination of parts within the fauces not admitting of inspection by unaided sight. It consisted of an oblong piece of looking-glass set in silver-wire, with a long shank. The reflecting portion is placed against the palate whilst the tongue is held down by a spatula, when the epiglottis and upper part of the larynx become visible in the glass. A strong light is required, and the instrument should be dipped in water so as to have a film of the fluid upon it when used, or the halitus of the breath renders it cloudy. The doctor proposes to call it the *glottiscope* (*b*).

The claim of Dr. Babington to be considered the inventor

(*a*) "Physiologie de la Voix." Par Ed. Fournié. Paris, 1865.

(*b*) *Lond. Med. Gaz.*, vol. iii., 1829, p. 555.

of the laryngoscope, was brought before the Royal Medical and Chirurgical Society of London on the 26th April, 1864, by Dr. M. Mackenzie, who exhibited the original instruments and the maker's invoice. It seems that Dr. Babington employed a hand-mirror to reflect the light of the sun on to the faucial mirror, which he at first combined with a tongue depressor. Of course, the principle of laryngoscopy was here acted upon. The "glottiscope," as the inventor called it, was, in fact, a laryngoscope such as we now use ; but we find that a concave mirror is better, as it brings the rays of light to a focus where their illuminating power is required, and artificial light is more manageable. Had Dr. Babington employed artificial light it is probable his experiments would have been more numerous and more successful. It cannot, however, be denied that he had really invented and used a laryngoscope.

Dr. Babington was present himself at the society when his claim was thus brought forward after the instrument had been perfected by others, who claimed to have invented it. He stated (a) that at the time his instruments were invented a great deal was being said about infiltration of the glottis, and it occurred to him that it was desirable to seek means of examining the glottis more narrowly. With his instrument he had seen ulceration on the epiglottis, but he confessed that he did not contemplate looking through the glottis. He expressed himself obliged for the remarks made in the debate, "although he considered that he had been praised far too highly." In this the reader will scarcely coincide, but put it down to Dr.

(a) *Medical Times and Gazette*, May 7, 1864.

Babington's innate modesty, for assuredly he had done much, and deserved much credit.

Soon after the late Dr. Babington, a Parisian physician, Dr. Bennati, employed an instrument made for him by a skilful workman, who was under his care for laryngeal disease. This fact was brought before the Academy of Medicine of Paris by Messrs. Trousseau and Belloc, in their classical work on "Laryngeal Phthisis," which is included in the "Memoirs of the Academy, &c.," 1837, vol. vj.

At a later date Trousseau reverted to the subject in his clinical lectures. Speaking of œdema of the larynx, he observes that it is unquestionably of importance to ascertain the existence of lesions, and then adds :—

"Examination of the larynx by a suitable speculum was felt to be a likely means of attaining this end. Long prior to 1837, when Dr. Belloc and I published our treatise on laryngeal phthisis, this idea had engaged the attention of practitioners; and at the date of our publication we were occupied with the construction of a *speculum laryngis*. At that time likewise M. Selligie, an ingenious mechanic, who was also a sufferer from laryngeal phthisis, made for his physician, an apparatus consisting of two tubes, one for throwing light on the glottis, and the other for affording a view of the image of the glottis, as reflected in a mirror placed at the guttural extremity of the instrument. There were, however, serious defects in this instrument; and the difficulties in applying it were so great that I long since ceased to use it. Laryngoscopy has been carefully studied in England and Germany; and you can read in the *Archives Générales de Médecine* for February 1860, an account by my friend, Dr. Lasègue, of the results arrived at by our colleagues on the other side of the Channel, and beyond the Rhine. When laryngoscopy shall have attained a greater degree of perfection, it will no doubt render service not only in the diagnosis but also in the treatment of laryngeal affections—particularly

in the treatment of œdema of the glottis, for sight ought certainly to assist the hand in the application of the topical remedies which are of such essential importance in treating that affection" (a).

Levret called (b) his instrument a *speculum oris*, and it is designated by a modern writer who has described and figured it (c) a pharyngoscope. It certainly cannot be properly called a laryngoscope, for it could never illuminate the larynx however useful it might prove in the operations for which it was designed. It merely combined a gag with a tongue depressor, and a mirror to reflect the polypi. It was in fact an improvement on the *specula oris* in use before Levret's time, one of which was figured in the works of Ambrose Paré in 1641, while others were mentioned by still earlier authors ; but all these early instruments may be looked upon as either tongue-depressors or mouth gags, in combination with simple mirrors, such as dentists have used from the earliest times. These certainly ought not to be spoken of as laryngoscopes.

In a foot note in his work just cited, Dr. Gibb claims to have used a steel mirror for inspecting the laryngeal surface of the epiglottis and other parts by direct light, a year before Czermak's first visit to London, and tells us that he figured it in 1860. This, however, was after the announcement of the discovery of the laryngoscope had been made in Germany and France. Indeed, Dr. Mandl's

(a) "Trousseau's Clinical Medicine." New Sydenham Society's edition. Lecture xxvi., vol. iii., p. 98. Translated by J. R. Cormack, M.D.

(b) "Observations sur la Cure Radicale de Plusieurs Polypes de la Matrice, de la Gorge, et du Nez." Paris, 1749.

(c) "The Laryngoscope in Diseases of the Throat." By George Duncan Gibb, M.D., 1864.

French translation of Czermak's work, from which Dr. Gibb translated it into English (*a*), was dated 1860, and that work was described by its author as a second edition of all the articles he published in various journals during 1858 and 1859.

My own use of a laryngoscope, in treatment as well as diagnosis, was four years earlier, as already shown.

An article has lately been published by Dr. G. Troup Maxwell (*b*), in which he claims for himself and for America the honour of having invented the laryngoscope. He says that "in the fall of 1858" he began to study diseases of the throat under the late Dr. Horace Green, to whom he he expresses obligations for his "marked courtesy" and admiration of his "transcendant skill." After "several months" Dr. Maxwell returned to his practice, and "in the beginning of 1859" devised an instrument and made a model. This he sent to Messrs. Tiemann and Co., with directions to make one, telling them for what purpose it was designed. "In the early part of November, 1859," Dr. Maxwell received his instrument and immediately used it. At first the mist from the breath dimmed the mirror, but he thought of warming it, and so, he says, "I was not long waiting to see my fondest hopes crowned with complete success, for in my mirror were reflected perfectly the whole of the posterior face of the epiglottis, the glottis with the vocal cords, &c." With this success, however, the author says he did not appreciate its importance, until he read, the next year, the encomiums passed on Czermak for obtaining the same results.

(*a*) "New Sydenham Society." Vol. xi. Selected Monographs, 1861.

(*b*) "Medical Record." New York, Jan. 15th, 1873.

Dr. Maxwell claims—1. Originality as an inventor. 2. Priority in the successful employment of the laryngoscope in America. Both these claims may be freely admitted, but it seems necessary to remind him, that neither Türk nor Czermak were the first to see the vocal cords. Dr. Maxwell says he has since informed himself of the experiments of Liston, Garcia, and others, and strangely enough adds, that at that time Czermak's results had not been made known in Europe, but his first public announcement was made in Paris, in April, 1860. It is likely enough that this may have been the first intimation given by American journals, but those results were completed and published in Germany during the two previous years.

Czermak tells us (*a*) he began his laryngoscopic experiments in the winter of 1857, his object being to obtain a clear idea of the mode of producing the Arabic *true gutturals*, and to verify and complete Garcia's physiological investigations. He adds that by a new method, viz., using artificial light and a large ophthalmoscopic mirror, he soon discovered the practical value of the laryngoscope, and his first paper was printed in the *Wien. Med. Woch.*, March 27th, 1858.

The labours of Türk (*b*) and Czermak stimulated a number of other able observers to devote themselves to laryngoscopy, and the result has been an advance in the art without parallel. Among the first to follow up the

(*a*) Czermak (J. N.), "der Kehlkopfspiegel, u. s. Verwerthung für Physiologie und Medicin." Leipsie, 1860.

(*b*) Türk (L.), "Prakt. Anleitung zur Laryngoskopie."

Türk (L.), "Klinik d. Krankh. des Kehlkopfes und der Luftröhre nebst einer Anleitung zum Lehr des Kehlkopfrachen Spiegels."

Türk (L.), Atlas des Ebend. Wien. 1866.

subject, was Störk, who still works at Vienna, where he has been re-inforced by Schrötter and others. Indeed, Germany has contributed more to laryngoscopical literature than other countries, as may be seen from the works of Semeleder, Tobold, Bruns, Lewin, Gerhardt, and a host of zealous writers. (a)

In France, Mandl, Fauvel, Krishaber, Fournié, and others previously quoted, have carried on the work.

Italy, and some other countries, have followed closely in the steps of Germany and France.

In England, we have not been slow to profit by what has been done abroad, and to contribute our full share to the progress of the art. Several names have already been cited, to which may be added those of Scott Alison, Durham, Smyly, Marcet, Windsor, E. Watson, Sieveking, Norton, and others.

Beyond the Atlantic our American brethren have been equally industrious. Elsberg at an early date took up the subject, and was succeeded by Oliver, Cohen, and several others, amongst whom I am happy to number some of my own pupils.

(a) Störk (C), "Zum Laryngoskopie." Wien, 1859.

Schroetter (Dr.), "Jahresbericht der Klinik für Laryngoskopie an der Wiener Universität." Wien. Braumueller, 1870.

Semeleder (F.), "die Laryngoskopie und ihre Verwerthung für die ärztliche Praxis." Wien. Braumüller, 1863.

Tobold (A.), "die chron. Kehlkopfkrankheiten mit spec. Rücks. auf Laryngoskopische Diagnostik und locale Therapie." Berlin, 1866.

Tobold, "Lehrbuch der Laryngoskopie und die lokal therapeut. Verfahrens bei Kehlkopfkrankheiten, 1863.

Bruns (R.), "die erster Ausrottung der Polypen in der Kehlkopfhöhle durch Zerschneiden ohneblutige Eröffnung der Luftwege."

Bruns (V. von), "die Laryngoskopie und die Laryngoskop. Chirurgie mit anleitung." Tübingen, 1866:

Lewin (G.), "Klinik der Krankheiten des Kehlkopfes." Berlin, 1863.

IX.

Practical Uses of Laryngoscopy in Diagnosis and Treatment. Changes in Colour. Varieties of Colour in Parts in Health. Hyperæmia. Laryngitis. Congestion of True Cords, of Cornicula, &c. Anæmia. Changes of Form. Increase and Decrease of Substance. Swelling. Œdema. Infiltration. Thickening of Epiglottis, of Cartilages. Phthisis, and other Causes. Hypertrophy. Exudation. Diphtheria. Deposit of New Tissue. Cancer. Polypi. Decrease of Substance. Atrophy. Degenerations. Necrosis. Gangrene. Ulceration. Accidental Changes Affecting Shape or Colour. Pigmentation. Foreign Bodies. Diseases not Affecting Colour or Form. Interference with Movements. Spasm of Glottis. Paralysis.

THE laryngoscope is an instrument which enables us not only to discover, but to treat diseases of the larynx; its practical uses may therefore be considered in reference both to diagnosis and therapeutics.

Laryngoscopy is merely the art of bringing within the field of vision certain parts that are ordinarily out of sight. It therefore renders easy the detection of diseases,

which, without it, can only be guessed at. True, before the introduction of the laryngoscope into Medical practice, many shrewd guesses were made by great men, but anyone who compares the literature of the pre- —with that of the post—laryngoscopic period cannot fail to be struck with the extent to which certainty has taken the place of probability in diagnosis. When we remember that the advance has been almost as great in treatment, we need not be surprised that laryngoscopy has taken so high a place in the estimation of those competent to pronounce on its claims.

The first practical use of the laryngoscope is as a means of physical diagnosis. The appearance of the laryngeal image in health has already been described at some length. It has, moreover, been mentioned that any deviations from those appearances must be attentively observed. It is to the discovery of such deviations from the normal condition of the organ of voice that the attention of the laryngoscopist is constantly directed. Some deviations may take place within the limits of health, and variations of natural conformation are not to be confounded with the changes produced by disease. Most of these are deviations either in colour or form, and may be separately considered. Of course, it is necessary to establish first of all a normal standard, and this has been done as to form, by the description that has preceded. Such descriptions give far less satisfaction as to colour. Hence it is the more necessary to study it by attentively examining the healthy human larynx. Difficult, however, as it is to describe colours, I will specify some of the main features of the colouration of a healthy larynx as a prelude to speaking of changes in colour.

The natural standard depends on the construction of the parts. It is to be remembered that the interior of the larynx at which we look, is covered with mucous membrane, the density and blood supply of which vary in different parts; while the sub-mucous tissues vary still more. The colour of the interior of the larynx may be compared to that of the mouth, the true vocal cords standing out in marked contrast, as white. There is, however, considerable difference in the depth of colour of the several parts. Thus, in the lip of the epiglottis, the yellow of the fibrous cartilage seems to shine through the pink mucous membrane. This is not observed in the cushion, which therefore looks bright red. The upper surface of the valve presents a more obscure colouration. The cornicula stand out in relief, being of a deeper, richer hue than the surrounding parts. The aryteno-epiglottidean folds are much lighter, closely resembling in colour the gums; while the false cords may be said to be a shade between these folds and the cornicula.

Now changes in colour may affect the whole larynx, or be localised in any of its parts. Moreover, the colour may be increased or diminished. In the one case we have hyperæmia, in the other anæmia. Sometimes such changes have taken place that it is not easy to say whether they have been brought about or depend on the one state or other. It is obvious, however, that any change in the circulation of the blood in a part may materially affect its colour. Diseases characterised by hyperæmia are easily detected, and in the mirror we can see the exact part of the larynx that is thus affected.

Acute, sub-acute, and chronic laryngitis, and the milder

forms often termed congestion of the larynx, can thus be diagnosed with certainty. They are all characterised by general hyperæmia, the intensity of the red colour of the mucous membrane sufficing to determine their differences. I am far from suggesting any inattention to other points, especially in acute diseases. The functions of the larynx are, of course, interfered with, and we may learn much from the voice, the cough, the breathing, and even the general symptoms, but it is obvious that to see the part is as desirable as in any other local inflammation.

Acute laryngitis is liable to give rise to œdema. This is very dangerous, since a slight degree of swelling may suffice to close the glottis. When œdema has taken place we have no longer the intense redness of the preceding stage, the effusion being only covered with the thin mucous membrane, which, although hyperæmic, when thus stretched loses much of its colour. We have, however, change of form. The swelling may be distinctly seen in the mirror, and its shape and extent made out. The epiglottis is generally not only intensely red, but considerably swollen.

Besides the active hyperæmia dependent on congestion from the arterial side of the circulation, we may see passive, venous congestion, in which case the characteristic dusky, or bluish tinge takes the place of the bright red.

There is a great difference in the shade of colour in the congestions met with in phthisis and syphilis, so much so, indeed, that to those who have had much experience, the hue is as suggestive in affections of the throat as in those of the skin.

Again, there may be want of colour, a true anæmia of the larynx, a condition to which I have long attached considerable importance, especially in reference to the

early stage of consumption. Semeleder is of a similar opinion, and though many others do not admit it, I am thoroughly convinced of the importance in this and other respects of noticing any approach to anæmia.

In regard to changes of colour localised in parts of the larynx, the importance of the disease depends on the degree with which it interferes with the functions. A slight hyperæmic condition of the true vocal cords at once manifests its presence by affecting the voice. It can be easily seen with the mirror, the whiteness of the ground bringing it into full relief. Increased redness of the false cords is not so prominent, but can always be readily detected. The corniculæ are very liable to suffer from congestion, and the deepening of their colour is at once manifest. We must not, however, hastily conclude that they are inflamed because they look redder than the surrounding parts, for, as just mentioned, their natural hue is considerably deeper. I have several times seen beginners erroneously conclude they were congested ; and the same caution may be offered regarding the cushion of the epiglottis, which is naturally redder than the lip.

Alterations in form constantly follow those of colour, and sometimes accompany them from the beginning. Swelling is as constant a symptom of inflammation as redness. We have seen that acute laryngitis often rapidly gives rise to œdema, and this may speedily terminate life. The condition is necessarily reflected in the mirror, and its extent can be accurately estimated. The laryngoscope is, in this case, a sure guide to treatment. But other swellings more localised may be observed. From this cause the epiglottis often completely changes its form.

In consumption it sometimes increases so much in thickness as to interfere greatly with the exploration of the interior of the larynx. In the same disease we frequently meet with tumefaction in other parts. The aryteno-epiglottidean folds are specially liable to be affected in this way, even in the early stage of laryngeal phthisis. Sometimes only one side of the larynx is swollen, but in most cases both folds are involved. Unilateral swelling suggests more localised disease, *e.g.*, abscess.

The cornicula are also very liable to enlarge in consumption. At an early stage they often appear slightly congested. Swelling may succeed, and in time the outline of the posterior part of the larynx be completely changed. The division between the cartilages cannot be distinguished, on account of the swollen condition of the parts, and the arytenoids, the cartilages of Wrisberg and Santorini, look like single, round, or oval bodies—one on each side. The swellings just described in phthisis are pale, and look so transparent that the beginner might easily fancy them to be produced by clear fluid, effused beneath the mucous membrane. Simple œdema is, however, still more transparent, for in phthisis the membrane itself seems to have lost some of its transparency by a deposit which makes it look thickened. In reality this is its condition, and thickening may often be seen at an earlier period.

So much stress has been laid on the swelling in this region as diagnostic of phthisis, that it seems desirable to insist on the still greater importance of thickening. It has, indeed, been stated that these swellings are pathognomonic of phthisis, but many authorities regard this as

erroneous. We must, therefore, look upon it for the present as doubtful. When the swelling is marked with a number of superficial yellow points, as if yellowish matter were exuding from enlarged follicles, the appearance is regarded as more significant, though we are not necessarily to conclude that these yellow points are actually due to the deposit of tubercle.

This thickening is not to be confounded with a somewhat similar state that is sometimes met with in syphilis. In the latter disease it is more irregular in form, and speedily goes on to ulceration, while the thickening that follows extensive ulceration of this kind is accompanied by great deformity.

It will be readily understood that several other conditions exist, characterised by change of form from increase of substance, and which may be spoken of as swelling, thickening, hypertrophy, infiltration, &c. Most of these arise in and are accompanied by inflammation. In fact, this process in the larynx is particularly manifested by the two first terms of its ancient definition—*Rubor et Tumor*.

Instead of simple tumefaction, the mucous membrane may be covered with an exudation, when the passage of the glottis may be quite as seriously narrowed. The exudation that occurs in croup and diphtheria, thus interferes with the respiration, and may be seen reflected in the laryngoscope.

In like manner we may see pus or blood in the larynx when suppuration or hæmorrhage has taken place in the respiratory tract.

Increase of substance also occurs from the deposit of

new tissue. This has been incidentally alluded to in speaking of the swelling in phthisis. Another example is cancer, in which the deposit of new substance is as marked as it is sometimes rapid.

The natural tissues may also be simply hypertrophied, and it may be difficult to draw the line between such hypertrophy and adventitious substance. The great deformity that is produced by cicatrisation may be mentioned as an example.

Polypi occur in the larynx far more frequently than was supposed in the pre-laryngoscopic period. These growths are as various in structure as in other organs. All may be included under the term increase of substance, inasmuch as they arise either from hypertrophy of the natural tissues, or the deposit of new material. Their exact position and shape are revealed by the laryngoscope, which further enables us, in suitable cases, to remove them.

We turn now to the opposite condition—decrease of substance. As diminution of colour may occur from deficient blood supply—anæmia—so this, in its turn, may give rise to wasting of tissue—atrophy. General atrophy of the larynx is a term sometimes applied to the condition met with in the aged, when, although the cartilages have become ossified, the removal of the softer structures renders them more transparent, and the mucous membrane and sub-mucous tissue appear to diminish in thickness. Such a state, *minus* the ossification, may also be met with in long standing anæmia or cachexia, or in the course of wasting diseases. Moreover, the tissues may undergo metamorphosis at the same time,

and then in place of simple atrophy we have degeneration ; fatty, lardaceous, or other.

It is to be remembered, however, that degeneration may accompany increase as well as diminution of tissue.

Necrosis and gangrene imply loss of substance, but they are almost invariably preceded by processes that cause tumefaction.

The most common form of disease characterised by loss of substance is ulceration. This too, it may be said, is preceded by the prior process of inflammation, in which the opposite condition of increase of substance, or at least tumefaction, is present. This stage has, however, sometimes passed away before the laryngoscopist sees the case. It may be added that ulceration in one part causing great loss of substance, is commonly accompanied by considerable swelling of other portions of the larynx. Ulceration may be simple, phthisical, or syphilitic. The two latter are by far the most common. Indeed, Mandl (*a*) says that up to the present he has never met with a case of catarrhal ulceration.

It is then important to distinguish between the forms of ulceration, and this is not usually difficult. In phthisis we find that ulceration is preceded by a stage of congestion, with thickening. It mostly begins in minute points, and gradually extends. The larynx presents a general appearance of pallor, even when portions, as already described, are both red and swollen. The true and false cords are both liable to attack, and, in advanced cases, seldom escape. The posterior commissure and the arytenoids are also often affected, and the

(a) *Op. cit.*, p. 332.

epiglottis is not unfrequently the seat of the disease—its edge appearing sometimes completely serrated. In secondary syphilis ulceration is not common, but in the tertiary stage it attacks the epiglottis, the arytenoids, the true and false cords, and the aryteno-epiglottidean folds. Syphilitic ulceration is usually deep and rapid, and gives rise to extensive loss of substance, and the deeper, dusky-red hue contrasts strongly with the appearances of phthisis.

Besides varieties of colour or form, or both, as the result of disease, we may trace accidental changes. Thus, in miners and others, the inhalation of dust of various kinds may cause the deposit of material of any colour or form in the larynx. Such pigmentation is quite superficial, but may obviously set up disease.

Another accidental change is the intrusion of foreign bodies into the larynx. Their appearance and position are revealed by the laryngoscope, which enables us to extract them.

Before dismissing the subject of changes of form, we may mention that the laryngeal canal may be narrowed and deformed by causes external to itself, such as the pressure of a bronchocele, aortic aneurism, or other tumours, in the neighbourhood. These may further produce a displacement of the organ.

On the other hand, the larynx, or trachea, may be dilated. Rokitanski attributes this condition to relaxation of the posterior wall, in which state hernia of the mucons membrane may occur. The dilatation is also said to result from general atrophy of the tissues, and might therefore be expected to be more frequently found in old age.

Besides changes in colour or form, the laryngoscope reveals lesions that affect the motor power. It will be readily understood that derangement of this function may arise from interference with innervation as well as more direct causes. A similar division may be made of diseases affecting this function, as of those causing change of colour or form. Thus, the motor power may be either increased or diminished.

Impairment of motor power may be slight, or it may proceed to its abolition, when we have paralysis of the glottis. So exaggeration of movement may produce slight or occasional symptoms, or it may appear as spasm of the glottis.

Derangements of motor function have received much attention from laryngoscopists, and often shed light upon diseases affecting the general system. Spasm may be slight or severe; recurring frequently or rarely; endangering life or causing only trivial inconvenience: it may be localised in single muscles or nerves, or it may be provoked by distant and deep-seated disease.

Paralysis of the vocal cords is still more important, and we can, by means of the laryngoscope, distinguish the muscles that are affected. Thus, the diminution of the movement of the cords may depend on paralysis of either the abductors or the adductors. In the one case the cords are not drawn to the sides of the larynx on inspiration, so that the opening of the glottis does not enlarge sufficiently during the act. In the other case the opposite condition exists, the glottis being widely dilated, and on attempted phonation the cords cannot be brought to meet in the median line. In either of these cases the

disease, instead of involving both sides, may be confined to one, when the cord of that side will be seen to be incapable of acting, although the motion of the other is distinctly visible. Minor forms of interference with motor power, and, of course, with the function of voice, may be traced to spasm or paralysis of the tensors and laxors of the vocal cords, but will not so easily be diagnosed by beginners.

As we are here only studying the conditions revealed by the laryngoscope, I have not touched on general symptoms, but think it sufficient to warn the reader that they are not to be forgotten. He will be but a sorry laryngoscopist who is a mere specialist, for the instrument is capable of rendering the greatest services to many branches of our art.

XII.

Principles of General Therapeutics Applicable to the Treatment of Diseases of the Throat. Laryngoscopical Therapeutics, or use of the Mirror as a Guide to the Hand in making Topical Applications to the Larynx, &c. Liquid Applications—Laryngeal Brushes—Probangs. Sizes and Forms of Brushes—Their Use—Effects of their Introduction—Occasional Distressing Symptoms, and their Relief. The Liquids used—Astringent, Sedative, and other Solutions. Vehicles. Laryngeal Syringes—Comparison between them and Brushes—Effects Dependent on the Force employed—Laryngeal Shower Bath or Douche. The Drop-Tube. The Pipette. Solid Applications. Powders. Insufflators. Effects and Uses of Powders—Astringent, Sedative, &c.

It is obvious that an instrument capable of bringing the interior of the larynx within the range of vision must serve as a sure guide to the treatment of its diseases. In the laryngoscope not only can we study the physiology of the larynx and detect deviations from its normal form, colour, or movements, but we may also watch the development and progress of such changes, that is to say,

the natural course of disease, and bring to bear on the part affected such remedies as may restore it to health. By the mirror we can guide the hand so as to enable us to make topical applications and perform operations within the larynx, and it is to such local treatment that the term laryngoscopic therapeutics is mostly restricted. There are, however, certain other remedies which cannot be omitted from even a brief sketch like this, as they are most valuable adjuvants to the other procedures, may, indeed, often be substituted for them, and are of still greater value in cases in which other parts than the larynx are involved. Such are gargles, fumigations, inhalations, &c. Moreover, local measures must not be allowed entirely to supersede general treatment. In the pre-laryngoscopic period physicians were deprived of the opportunity of applying to the larynx remedies they were accustomed to use in diseases of other organs, and thus their treatment was naturally as defective as their diagnosis was obscure and difficult. Now, however, the reverse condition obtains, and the principles of general therapeutics are apt to be forgotten, while the larynx is often subjected to an amount of local treatment that would be considered excessive in other organs.

Although I was the first to resort to laryngoscopic medication, I have always deprecated excessive topical applications to the delicate organ of voice, and urged the necessity of availing ourselves of constitutional remedies. Success as a laryngoscopist is not to be attained by devoting exclusive attention to a single organ, as though that were not after all but a small part of the body. The whole aim of the physician is to cure, or if that be im-

possible, to relieve his patients, and this can only be attained by a careful study of all the conditions, many of which relate to the general health rather than to slight deviations from the natural condition of a single part.

Having put in this plea for general therapeutics, it will be unnecessary to dwell upon the application of the principles involved, and I pass to a consideration of remedies of a more special character.

Laryngoscopical therapeutics may be said to comprise the application of remedies to the larynx or other parts by the aid of the mirror. We thus include the topical treatment of the fauces, posterior nares, &c. The hand being guided by the mirror, we may apply to any part either liquids or solids, or we may use instruments for the performance of operations. As the larynx is the most important organ, giving the name to the mirror, and at the same time the most difficult of access, we begin with it, and will first consider the methods of applying to its cavity liquid remedies.

The student who has learned the use of the mirror and educated both his hands in the manner previously described, will not find much difficulty in introducing into the larynx an ordinary laryngeal brush (Fig. 39).

Simple, however, as this operation seems, it requires care and dexterity, and gives rise to disagreeable effects. As a preparation for performing it the beginner may pencil the fauces in cases requiring it. For faucial application a probang is sometimes employed (Fig. 40), and there are cases in which this instrument may be preferred, though the brush may be made to serve almost all purposes. Brushes should be well made and of assorted sizes, and the physician will require a number in proportion to the

extent of his practice in the department. The best are mounted on aluminium wire, which has the double advantage of being easily bent, and not readily affected by the



FIG. 39.

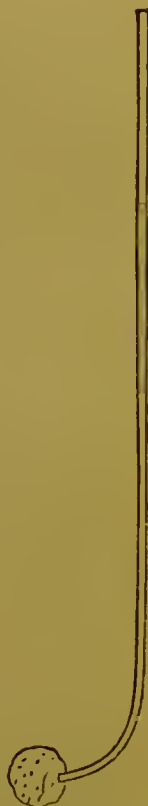


FIG. 40.

liquids usually employed. The angle in Fig. 39 is constantly sold, but is not so often useful as a right angle, which I mostly employ and strongly recommend. It.

is well for the handles to be of the same size, and not less than 8 inches in length. When the aluminium wire is employed, 1 or 2 inches of that substance may be included in this measurement, which is taken from the end to the angle; thus the horizontal part of the instrument is 8 inches in length—6 or 7 for the handle—wood or ebony—and 1 or 2, as the case may be, for the wire. The length of the perpendicular part is of more importance. For an adult it should never be less than 2 inches from the angle to the end of the camel-hair brush. Two and a-half and three inches are more frequently required.

The use of these brushes is to apply fluids to the diseased mucous membrane, a mode of treatment which the laryngoscope enables us to carry out with precision and than which none is more efficacious.

The readiness with which the larynx resists the intrusion of foreign bodies is so well known that surprise is often expressed at the little distress occasioned by this mode of treatment when skilfully carried out. Unpleasant symptoms are, in fact, the exception rather than the rule. Indeed, visitors to the hospital sometimes remark that after watching several persons during the whole afternoon, making applications to the larynx by the brushes, they have not seen a case in which disagreeable effects followed. This may depend on several circumstances. Thus, in a hospital many of the cases have been under treatment for some time and become accustomed to it; and it is one of the most important facts that we may train very sensitive persons until the larynx easily tolerates the constant use of instruments. It is to such training that we sometime resort to prepare for ope-

rative proceedings within the larynx. In some diseases the sensibility of the larynx appears diminished. Besides these circumstances there can be no doubt that to take the larynx by surprise as it were, and brush it with that degree of firmness which characterises the skilled hand, is far less likely to cause spasm or distress, than is the sudden intrusion of a small body, like a crumb or a drop of water, which so frequently, when it "goes the wrong way," gives rise to spasmodic efforts to eject it.

Still, even in the most skilled hands the brush may occasionally set up a choking sensation, a degree of irritation or pain, a contraction of the vestibule, and even a true spasm of the glottis. Such symptoms are, however, very transient, as is also the change in the voice, that may surprise the patient. They give rise to alarm in the mind of the sufferer, who, if not forewarned, should be at once assured that there is no danger, and, if possible, induced to speak. The utterance of a single word gives complete relief. This, however, may be difficult, and Voltolini's advice is perhaps the most efficacious—viz., to hold the breath a moment, when the spasm will at once subside. The effects of the mechanical contact of the instrument being temporary, we have next to consider those of the liquid with which the brush is charged. These differ with the nature of the liquid, which may be astringent, stimulant, sedative, &c. The selection of the liquid will be made in accordance with the principles that guide us in the local treatment of other diseased mucous surfaces, modified only by the conditions that are special to the organ under consideration.

Solutions of silver nitrate were among the earliest employed, and in suitable cases were of great value. Some writers think this substance the most liable of all to give rise to spasm, and for that reason have nearly discarded it. Others do not accept this doctrine. The fact is, that the effects of this remedy differ much with the strength of the solution. I have used it from 5 grs. in the oz. to 120, and though other remedies may often be advantageously preferred, I cannot look upon it as a simple astringent, or consent to altogether deprive my patients of the benefit of its remarkable properties.

Solution of perchloride of iron is an invaluable astringent, and may be used in various proportions, from a few grains up to one or two drachms to the ounce. Iron alum and ordinary alum may likewise be used in a solution of 20 to 60 grains per ounce. Of zinc the chloride is the most efficient salt, and its strength may vary from 10 to 30 grains. The sulphate is, however, also useful, 40 to 60 grains being dissolved per ounce. Chloride of aluminium is a powerful astringent, and may be used in this way as well as by other modes. Pure sulphurous acid can be used in the larynx, as also can many other substances, including tannin and most astringents. Iodine is much relied on by some, but I do not often use it in this way. Lastly, I may mention carbolic acid, of which from 10 to 30 grains of the crystals per oz. may be employed.

The solutions may be made in simple distilled water, or a portion of glycerine may be added. It has been proposed to use the latter only as a solvent, but this is not desirable, as it is an irritating fluid, glycerine being far from the bland liquid it is frequently called. When

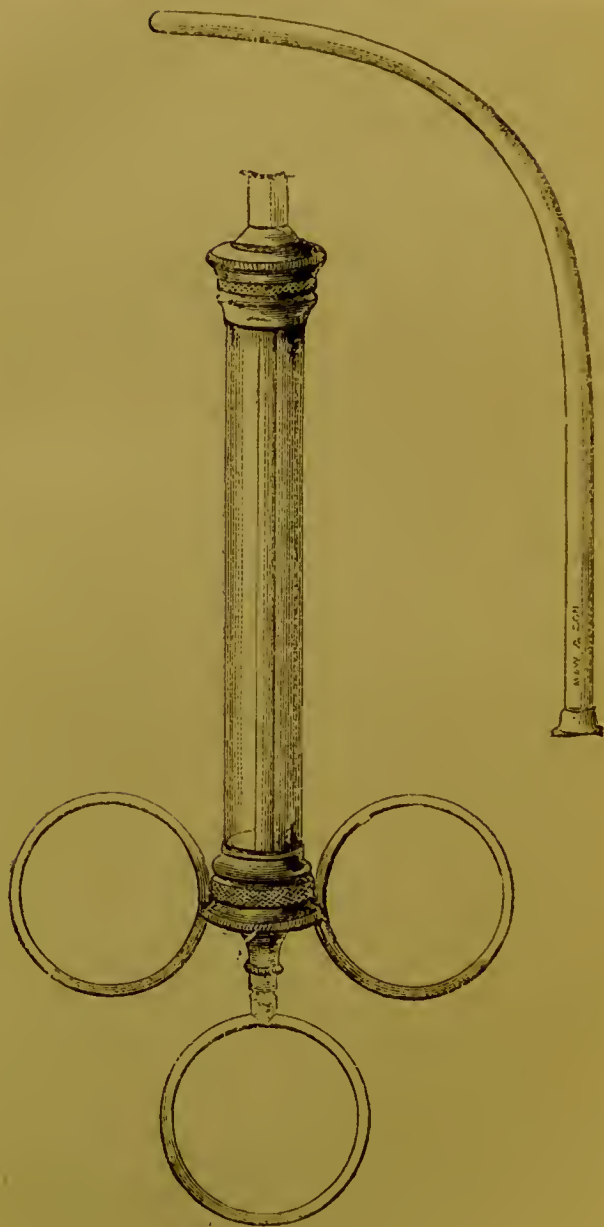


FIG. 41.

mixed with water, however, it loses much of its irritant quality, and the consistence of the liquid is increased. Its slowness to evaporate may also be regarded as some advantage.

For making applications to the interior of the larynx the superiority of well-made brushes to probangs is incontestable. There may occasionally be reasons for preferring the sponge, but then the probang must be prepared on purpose ; those usually sold being only fit for application to the fauces and pharynx. It is the unsuitable form of these probangs that has led to their disuse.

Medicated liquids are sometimes injected into the larynx by means of a syringe. It is obvious that with the aid of the mirror there could be no more difficulty about this than about other instruments, provided the pipe of the syringe be of sufficient length and of a proper curve.

Fig. 41 shows a syringe of the kind usually sold, and the only inconvenience of which is, that the barrel is, in my opinion, too large. It is not necessary for it to hold much. A piece of sponge may be introduced into a syringe of this description in order to diminish its capacity and modify the force with which its contents are ejected on pressing the piston.

A smaller syringe is figured in the next engraving, and, moreover, the nozzle of this is perforated with a number of small holes, in order that the liquid may be distributed in the laryngeal cavity in several streams. This is nearly the form first used by Tobold, but the curve is rather too slight. It should not be less than that of Fig. 41, and usually I prefer it to be nearly or quite at a right angle. Mr. Erichsen has adopted the

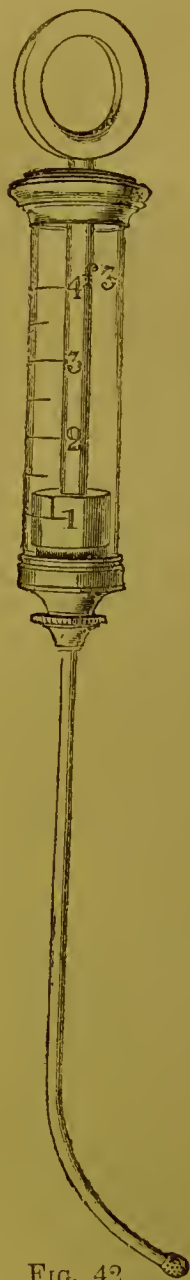


FIG. 42.



FIG. 43.

same form of termination to the elegant syringe he recommends (a) for injecting solutions of nitrate of silver into the larynx. His instrument holds less than the preceding ones, and so far is preferable. A further improvement would be to make the angle more acute and to increase the length from the angle to the perforated extremity.

In Gibb's laryngeal douche the same form of pipe is furnished with a caoutchouc ball. By compressing this the air is expelled, and any liquid into which the end is dipped will enter on the pressure being removed. When thus charged it can be used for the same purposes as a syringe. This instrument is much improved by the addition of a pair of rings, as shown in Fig. 43, and the use of which in facilitating the application is apparent from the engraving.

The mode of injecting fluids into the larynx by any of the preceding instruments requires no detailed observations. The only requirements on the part of the operator are steadiness and dexterity. The laryngoscope must always be employed. Holding the mirror in his left hand, the operator, guided by sight, introduces the end of the syringe into the larynx in just the same way as a brush, sound, or other instrument, completing the operation by pressing his thumb on the piston with that degree of force he desires to employ.

This brings us to consider the special action of injections. Sudden and forcible pressure evidently projects a douche on the walls of the larynx, while the feeblest

(a) *Science and Art of Surgery.* Sixth Edition. Vol. vii. Pp. 459.

possible compression will only cause a few drops to exude from the tiny apertures, and collect into one, which falls into the cavity. Between these two extremes there are many degrees of pressure, and the effects will vary accordingly. Unless we intend to use sufficient force to drive the fluid as far as the walls of the larynx, there is no advantage in having the end of the syringe furnished with numerous tiny perforations to break up the stream. If we use sufficient force to project the fluid on the membrane, clearly we administer a sort of shower bath to the larynx, and the influence of this ought not to be overlooked. There is another difference between the use of syringes and brushes. In using the latter we touch the mucous membrane with a foreign body, and this has been urged against their employment. I have, however, shown that very little irritation is caused by the skilful use of well-made brushes. On the other hand, injections are in reality far more distressing. Whether a powerful douche be projected into the larynx or only a drop or two slowly injected, violent spasm is very liable to be caused. In the former case many would naturally anticipate this result ; but in the latter it is quite as frequent, and sometimes more severe. Part of the effect may be due to the shock of the stream on the walls of the larynx ; but when only a drop or two is injected, we have just the inconvenience that is set up when in drinking or gargling, liquid is drawn into the air tube by inspiration. Everyone knows that if a single drop "go the wrong way," the dyspnoea, cough, and spasm may be extremely distressing. The best way to relieve these symptoms is to "hold the breath" resolutely for a few seconds. Patting on the back, drinking a drop

of water, and speaking are also advised. Drinking is a relief when the spasm abates, but cannot be tried until then. The utterance of a single word will often suffice to restore respiration.

A consideration of the little accidents alluded to seems to show that the smallest drop of liquid approaching the cords immediately provokes them to close the glottis; and the tendency of this orifice is to remain shut until the fluid has disappeared from the surface of the cords by becoming diffused throughout the cavity. If the respiration could be easily suspended, this would soon be accomplished in the case of a small quantity; hence the use of the direction to hold the breath. Moreover, the disposition to spasm is exhausted by the contact of the fluid. When the liquid passes by surprise below the glottis, the cough set up is more violent still. Hence it is a common plan to direct a patient to expire during the injection, or better still, to utter a falsetto note.

From what I have stated, the reader will be able to draw his own conclusions as to the relative value of brushes and syringes. In making his estimate he must not forget that by means of the former it is possible to localise the application to a portion of the larynx. This cannot be done so well with the syringe, though it may with care be accomplished when only just enough pressure is used to let a drop of the contents ooze through, and collect at the end. For such a purpose, however, the drop-tube made by Leiter, of Vienna, (Fig. 44,) is more appropriate. In this instrument, at a convenient position to apply the forefinger, there is a reservoir (*a*), which is covered by a thin elastic plate. By pressure on this

when the point of the tube is submerged in the liquid, the reservoir is easily charged. The tube being introduced by the aid of the mirror, and the finger gently pressed on the elastic plate, the liquid is exuded drop

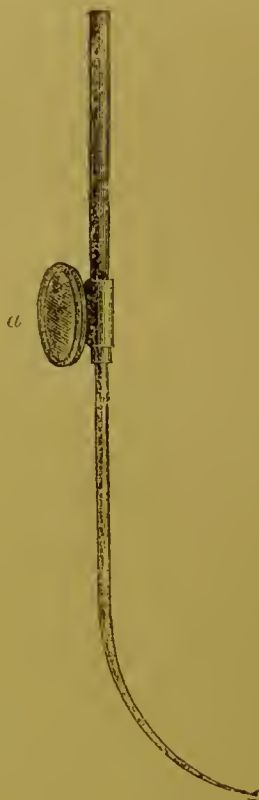


FIG. 44.

by drop, the operator all the time retaining complete control over the quantity thus instilled into the larynx. I have adopted the principle of the pipette for instilling fluids, drop by drop, into the larynx, and this

is a more simple plan than even the drop-tube. The patient should emit a high note during the operation. If through a sudden inspiration, or from the cords being allowed to remain open, and being taken by surprise, a drop of liquid should pass the glottis, a violent paroxysm of cough and dyspnœa will at once supervene, just as in the other cases in which the same symptoms have been mentioned as likely to occur. For this and other reasons I employ brushes much more frequently than syringes, the drop-tube, or the pipette.

Instead of liquids we may apply solid remedies within the larynx. The use of caustics will be considered further on. Here I desire to point out that solid remedies reduced to the form of an impalpable powder may be introduced into the larynx with as much benefit as frequently follows their use in the pharynx. Such applications have been made in various ways. Thus patients have been placed in an atmosphere in which the powder was diffused, others have been taught to draw the remedy into the larynx by a deep sudden inspiration. These processes, however, belong to another branch of the inquiry. At present we are concerned with laryngoscopic therapeutics, or the art of applying remedies by the aid of the laryngoscope. For the purpose of thus applying powders we employ an insufflator, which is an instrument for projecting the fine powder by a puff of air. In the ordinary insufflator of Rauchfuss this is accomplished by means of an india-rubber ball, pressure on which forces out the powder. It is, in fact, only an adaptation of the douche. The difficulty of holding the tube in position while suddenly compressing the ball has led some to resort to other means of blowing out the powder. They

have accordingly substituted for the elastic ball used by Rauchfuss a long piece of india-rubber tube, with an ivory mouth-piece (Fig. 45). This enables the operator to project



FIG. 45.

the powder at the right moment by a puff from his own mouth ; for it is to be observed that both his hands are engaged, one holding the mirror, the other the insufflator.

Many naturally object to blow from their own mouth in this manner. They employ, therefore, a longer tube and a larger hand-ball, which they entrust to an assistant, who compresses at a signal from the operator. The objection to this method is manifest. The tube may be attached to a pair of bellows, which may be placed between the operator's knees, or better still under one foot, which soon becomes educated to the work. In hospital practice this is a convenient plan.

The engraving of the insufflator given shows the opening for introducing the powder, and the slide which covers the aperture when the instrument is charged.

Schroetter uses a glass tube of the shape of the insufflator already depicted, as far as the junction of the elastic tube, but there he prolongs the glass and turns it to the side at an obtuse angle. This gives it as it were a handle, and keeps the hand while holding it quite out of the way. An elastic tube completes the apparatus. I have had tubes of this shape made of vulcanite instead of glass. I have also had the openings so arranged as to enable the operator to localise the application to any part of the larynx. This I accomplished by having several tubes, each of which differs from its fellow in the position and shape of the opening. The most useful forms are three—one with the usual termination, one with a slit on the right side, and a third with a slit on the left side.

The idea of projecting a cloud of fine powder into the larynx will to some persons suggest a violent paroxysm of cough as the immediate result. They imagine, perhaps, that a solid, however finely powdered, must be more irritating than a liquid, and it may be that this notion has

tended to restrict the use of these remedies. In this country they do not seem to have been as fairly tried as they deserve. In suitable cases powders are not more irritating than many solutions in common use, and I venture to put in a plea for their more extended use.

The effects produced by a cloud of dust falling on the mucous membrane will differ with the nature of the particles of which the dust is composed. An insoluble powder thus applied to healthy membrane provokes some irritation and an increase of secretion. The mucus thus thrown out envelops it, and the whole is soon expectorated. If the powder fall on the cords more irritation and spasmodic cough are caused. Soluble powders will dissolve in the secretion, and running down the walls of the cavity, may cause cough at a later period, that is, on arriving at the glottis. Whether soluble or not, the powders may be astringent, sedative, stimulant, &c. And some influence is in every case to be attributed to the shock caused by the impact of the particles on the parts. The powders most frequently employed are sedative, narcotic or anodyne, and the salts of morphine are usually selected for the purpose. Among astringents are tannin, gallic acid, acetate of lead, sulphate of zinc, &c. Nitrate of bismuth, oxide of zinc, and other powders have also been employed. Nitrate of silver has sometimes been used in this way, but I do not recommend it.

To regulate the strength of these remedies, we mix them with indifferent powders. Loaf sugar has been freely used, but sugar of milk is better. Phosphate of lime has been also used. Talc is an excellent substance. In regard to astringents, their action may be diminished

to any extent by increasing the quantity of the sugar of milk or talc. Morphine may become to some extent absorbed, and so act as a general narcotic. The quantity used is generally small. From one to four grains in the ounce may be required. The use of this powder with the insufflator may prove a source of great comfort in advanced laryngeal phthisis and other diseases. Moreover, we may combine astringents with morphia in any proportion. Evidently, then, there is a considerable sphere in which powders may be employed in the larynx, and it seems needless to add that this sphere is rendered much greater by the admirable results obtained from these remedies in diseases of the fauces, in which they can be applied without the laryngoscope.

XIII.

Application of Solid Caustics within the Larynx. Caustic Holders. Effects of Caustics on Mucous Membranes generally. Effects within the Larynx. Inconveniences. The Various Caustics. Their Uses—to Destroy Tissues, to Modify Action: Other Operations. Searifying. Laryngeal Lancets. Œdema. Abscess. Interstitial Injection. Electrolysis. Removal of Growths.

THE resources of laryngoscopic therapeutics have not yet been exhausted. Not only may we apply liquids or powders to the interior of the larynx by the methods previously described, but we may by the aid of the mirror apply solid caustics to small and defined portions of that organ. Nitrate of silver is the most frequently used substance of the kind, and was the first ever employed for the purpose. Various forms of caustic-holders have been designed for the purpose of facilitating the procedure. Most of them conceal the caustic until the instrument is introduced to the spot to be cauterised, when it is propelled forwards by pressure on a spring; on removal of the pressure the caustic retreats within the sheath. Such a contrivance will give confidence to the beginner, and is con-

stantly used by some laryngoscopists. I have, however, abandoned it in favour of the more simple naked conductor. It is desirable for everyone who intends to practise laryngoscopical manipulations of an operative kind to be able to apply caustic to minute portions of the laryngeal surface. Indeed, this procedure should be looked upon in the light of a surgical operation. For this reason, I did not consider it when treating of the employment of solid remedies by means of the insufflator, but reserved it as an introduction to the subject of operations within the larynx.

The holder I employ closely resembles the laryngeal brushes already described, without the termination. It consists of a handle of the same shape and size, mounted with aluminium wire of the same form; but the wire terminates in a rough bulb, instead of having a camel-hair brush affixed. The nitrate of silver is fused in a small crucible, and the rough bulbous end of the aluminium wire dipped in. The bulb is thus covered with a thin coating of the caustic, and the instrument is ready for use. A minute or two suffices to charge in this way twenty or thirty holders at the cost of a few grains of the silver salt, and they can be kept ready for use. One of the greatest advantages of this simple instrument is, that it is impossible for a piece of caustic to break off and drop into the larynx—an accident that may occur with some of the more complicated holders. Instead of the bulb at the end, we may have depressions hollowed out on either side, into which the fused nitrate may be run; and other variations in the form of this simple instrument are occasionally serviceable. Besides only coating one side of the instrument, we may secure still further protection by

covering the other with a paste containing some table salt. Should then some of the nitrate left on one cord come into contact with the other, it will be decomposed by the salt that is left upon the sound cord, and the silver chloride will produce no effect. The holder should be cleansed and recharged after each occasion on which it has been used.

The effects of nitrate of silver on mucous surfaces generally are familiar to all practitioners. In the larynx it may produce the inconvenient symptoms already described as sometimes supervening in the application of liquids. Great care should be exercised to confine its effects to the parts on which it is desired to act. It should be remembered that, on becoming dissolved, the solution naturally spreads somewhat on the surface of the membrane. Moreover, the movements of the larynx itself tend to increase this liability. It is often very desirable that the action of the caustic should be particularly limited. In such cases, if unusual sensitiveness exist, it may be desirable to train the patient in the same way as for still more delicate operations.

Sometimes the slighter effects of nitrate of silver are easy to obtain when the deeper action is prevented, because contraction of the ventricle, suffocative cough, or movement on the part of the patient prevent the more prolonged application of the remedy, and its firmer pressure on the part. Much of the good effects desired may, however, be gained by a little patience, so that the use of more potent caustics is seldom called for. They have, however, been employed. The caustic alkalies are not well adapted for use within the larynx, nor is the *potassa*

ē calce. Objections also exist to sulphate of copper and bichromate of potass, as solid caustics. In rare cases chromic acid has proved very valuable. For ordinary purposes nitrate of silver is the most suitable as well as the least dangerous.

Caustics may be used for various purposes. They are of the utmost value in certain cases of deep ulceration. When rapid destruction is going on by the ulceration of the later stage of syphilis it may often be arrested by thorough cauterisation, and thus give time for constitutional remedies to be brought to bear.

Caustic is also successfully used for the removal of hypertrophy, induration, and thickening of limited extent, as well as for the destruction of more defined growths in the larynx. Cauterisation is further frequently employed to the pedicle of a polypus that has been removed by instruments. Nitrate of silver is also employed with the object of modifying the condition of mucous membranes, but within the larynx the solution is more appropriate for this purpose than the solid substance.

Some laryngoscopists employ the powdered nitrate by means of a delicate insufflator, and there are cases in which it may be desirable to resort to this method. For moderate cauterisation the nitrate should be diluted with two or three times its weight of sugar of milk or magnesia. For a more potent caustic equal parts may be employed. This will produce a more intense cauterisation than the use of the solid as above described, inasmuch as a larger quantity of the caustic remains on the surface—from a scruple to a dram of the powder being blown in at a time.

He who has acquired skill in applying solid caustic will not find it a great advance to proceed to the use of the laryngeal lancet, and it is desirable he should take an early opportunity of doing so, inasmuch as by this means he may be able on an emergency to snatch a fellow-creature from the very jaws of death. In those cases of rapid œdema in which the patient is being suffocated, the only plan is by means of the laryngeal lancet to give exit to the fluid, and thus at once restore the power of breathing. The same instrument is also occasionally required to open an abscess, and it has been employed as a scarificator in certain other conditions arising in inflammation. It is, however, to be resorted to with reserve whenever there is not great emergency in the case.

The laryngeal lancet is made of a similar shape to the other instruments, but the blade varies with the fancy of the operator and the object to be attained. The majority of operators use guarded lancets, the points of which can be pushed forward at the exact moment, and which at once spring back within their sheath. The engraving, Fig. 47, shows a laryngeal lancet in combination with a handle of a similar pattern to that used by Stoerk for his guillotine. Other models are to be seen at all our instrument-makers'. I prefer the simpler form of unguarded lancets, mounted on handles like those of the laryngeal brushes. They give more power and precision. In skilled hands—and others ought never to touch them—they are not excessively dangerous.

The next operation may be termed interstitial injection. It is analogous to hypodermic injection, but far more difficult. By means of a small pointed syringe of a proper form fluids are injected beneath the mucous membrane of the larynx, or into the substance of morbid growths in that organ. Some successful cases have been recorded; but last year a patient died in Vienna a few minutes after the operation, and it is since less frequently resorted to. It is a method of treatment I do not recommend.

Besides the operations already described the application of electricity remains to be considered.

One of the most delicate operations that have been performed is that of electrolysis within the larynx. Professor Fieber, of Vienna, has related several cases of growths which he has succeeded in removing by this method. I was at the time occupied in making similar efforts, but was anticipated by him in the publication of the results, and therefore contented myself with recording his cases (*a*).

The galvano-cautery may be employed instead of the other methods of removing growths. This operation is one of great nicety, but has proved very successful. The instruments I employ are modifications of those recommended by Von Bruns, Voltolini, and others.

Faradisation of the larynx has been found very successful in functional aphonia. It is accomplished by means of

a) Medical Press and Circular, 1872

a properly insulated electrode of the form of a laryngeal sound, which, having been attached to the wire of one pole, is carried into the larynx, the other pole having been previously applied to the neck. The circuit is completed by pressing the index finger on a spring. This operation is a simple one; only a small battery is required, and the result usually satisfactory. Dr. Morell Mackenzie first proposed (*a*) to treat aphonia by Faradisation. His electrode—described in 1862, and exhibited at the British Medical Association in 1863—is the most convenient. Indeed, the only modification of importance is that proposed by Dr. Fauvell and adopted by the inventor as an additional instrument. This is the employment of two electrodes together, separated at the laryngeal extremity by about one-eighth of an inch. This instrument is used for Faradisation of the thyro-arytenoid, arytenoideus proprius, or posterior crico-arytenoid muscle. Dr. Mackenzie has also suggested a third electrode, in which the extremities are separated to the extent of five-eighths of an inch, so that one pole may be in the larynx, the other in the hyoid fossa. He recommends this modification “in cases of unilateral paralysis of the adductors of the vocal cords.” I have had many cases confirmatory of those he relates (*b*).

Either the intermittent or the constant current may be also employed for various diseases in the throat without

(*a*) *Medical Times and Gazette*, 1862.

(*b*) “On Hoarseness, Loss of Voice, and Stridulous Breathing, in relation to Nervo-Muscular Affections of the Larynx.” London: 1863. Also *Med. Press*, Jan. 11, 1866.

the introduction of one pole into the larynx. Those familiar with electricity will find no difficulty in this, and as it scarcely belongs to *laryngoscopical* therapeutics, it is unnecessary to say more of it in this place.

Growths in the Larynx, and Operations for their Removal.

THE laryngoscope revealed to us that morbid growths in the organ of voice are much more frequent than had previously been suspected, and at an early period attempts were accordingly made to remove them by mechanical means. *Ecraseurs*, wire loops, guillotines, and forceps of various kinds have been designed for this purpose. To Czermak is due the credit of being the first person to discern a polypus by means of the laryngoscope. The patient had suffered from hoarseness for a long period, and Czermak detected the growth in January, 1859, as related in *Wiener Mediz. Wochenschrift*. Lewin seems to have been the first to dare to extirpate polypi, which he tells us (*Deutsche Klin.*, 1862) he did in 1860 by means of forceps and other instruments introduced by the aid of the laryngoscope. In France, Fauvel employed forceps in 1861 (a). I believe the first person in England to remove a laryngeal growth by mechanical means was Dr. T. W. Walker, of Peterborough, who described his *écraseur* in the *Lancet* in November, 1861.

It will easily be understood that there is no small diffi-

(a) "Du Laryngoscope au point de Vue Pratique."

culty in carrying a simple loop of wire round a growth in the larynx. Many, however, prefer this method of operating. Gibb's instrument, made by Weiss, is suitable for the purpose. It consists of a carrying-handle for the wire, and a sliding cross-piece, against which the two first fingers rest. The wire being passed through two small holes at the point is carried along the groove and through the holes of the cross-piece, leaving a loop at the point of the size required. Two or three twists round the cross-piece suffice to fix it firmly. The instrument is to be very carefully introduced by the aid of the mirror, and the loop passed round the tumour like a noose, when it can be tightened by gentle, steady pressure between the thumb and fingers. The base of the polypus is thus divided, and its substance withdrawn in the loop.

Before introducing this or any similar instrument, the loop must be placed in such a position as to pass over the growth to be extirpated, and its size and shape should also be properly adjusted. If the growth be located on one of the true vocal cords the loop must correspond with the antero-posterior diameter of the larynx, while if the growth be situated in the anterior commissure, or on the under surface of the epiglottis the loop must be arranged transversely to that diameter.

Contact with any part during its introduction will alter the shape of the loop, and so render it useless when it reaches the growth. Thus, supposing the loop to have been made round, and of a certain size, so as to pass over a growth, should it come in contact with the wall of the pharynx, or any other part, either accidentally or through reflex action on the part of the patient, it is obvious that

the round opening will be made oval by the pressure, and so not adapted to pass over a globular growth. Moreover, spasmodic contraction of the larynx will sometimes occur, by which the loop may be bent to either side, or backwards or forwards. To meet these difficulties Stoerk contrived his guarded wire-loop *écraseur*, Fig. 46, in which the flexible wire is protected by a solid metallic loop. By this instrument very thin wire may be employed with greater ease than stouter wire without the protector

In Stoerk's guarded *écraseur* a metal tip bored with two holes is screwed on in such a way that the holes can be placed either antero-posteriorly or transversely, and thus the loop arranged for growths in various positions.

In favourably situated growths it is possible, with but little training of the patient, to introduce an unguarded loop, but for this purpose the wire employed must have a certain degree of firmness to enable it to retain its form. Good iron wire is perhaps the best for this purpose. That used for musical instruments is both stiff and elastic, and not too easily mis-shapen. Silver and platinum-wire are both very flexible, and therefore need the guard.

Sometimes the operator may be successful in his first attempt to snare a growth. It more often happens, however, that many fruitless efforts are made. This is especially the case when the patient has not been properly trained, and in all cases it is desirable that the larynx should be accustomed to the contact of instruments before the attempt is made to extirpate a polypus. It will be readily conceived that some forms of growth are better



FIG. 46.

STOERK'S WIRE-LOOP
ECRASEUR.

(a) Handle. (b) Ring for thumb. (c c) Ring for middle, and half-ring for index finger. (d) Wire carrier. (e) Protector. (f) Loop. (g h) Additional protectors.

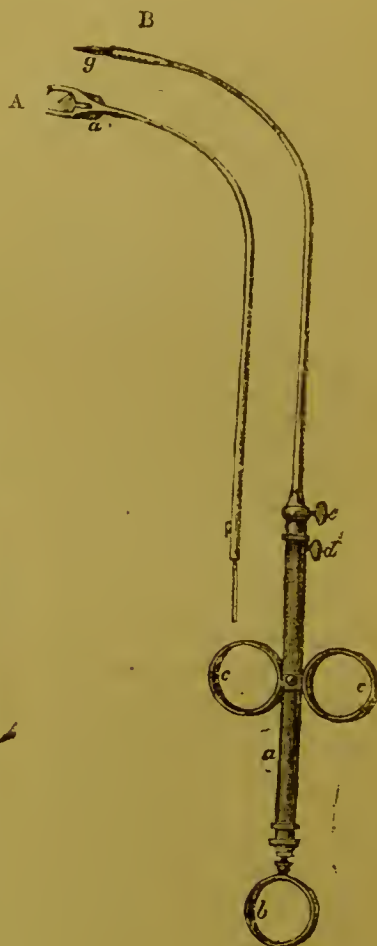


FIG. 47.

A, TURCK'S GUILLOTINE. B, LANCET,
WITH LEITER'S HANDLE.

(a) Handle. (b) Ring for thumb. (c c) Rings for fingers. (d e) Screws for fixing tube and contained wire. (g) Laryngeal lancet. The guillotine is separate, its blade and sheath being marked A.

adapted for this operation than others, and therefore that other instruments have found favour.

Among these we may next consider guillotines. Türk designed one of these which is used by some to this day. A handle somewhat like that of Stoerk has been adapted to Türk's guillotine by Leiter. The engraving, Fig. 47, shows this modified instrument. The guillotine itself, A, is seen to be of a square shape. The blade *a*, which in the figure is retracted, is either lance-shaped or has only one cutting edge. It acts by being pressed forwards, and therefore can be easily employed with the same handle as is the laryngeal lancet, B. If this form be employed it is better to use the handle which Türk himself contrived for it, and in which the required forward movement is most easily made.

Stoerk's guillotine differs from Türk's in its shape and mechanism. The handle is very convenient and adapted to a variety of instruments, as will be seen on reference to the engraving, Fig. 48. This handle consists of a rod *a*, a ring for the thumb *b*, two others *c c*, for the index and middle fingers. Into this handle the guillotine is fixed by passing through two apertures, one for the tube, the other for the wire which is connected with the blade, each being retained in position by screws as seen at *d, e, f, g*. The wire passes through the tube to the blade. When the screws are properly fixed the tube itself does not move, but traction can be made on the wire by pressing the fingers towards the thumb, when the rings slide along in the handle, drawing the wire, and of course the blade to which it is fixed, forwards.

It will be observed that this instrument cuts by being

drawn up into its sheath, the motive power being the simple approximation of the fingers and thumb in the rings of the handle. This movement is certainly easier

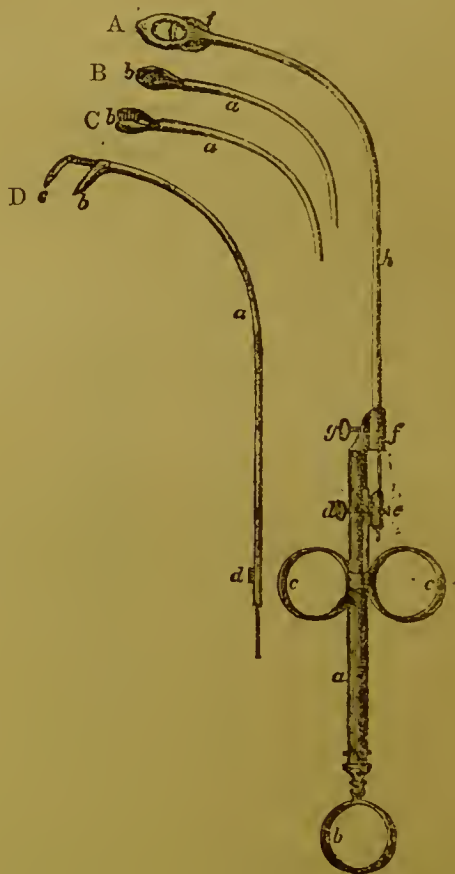


FIG. 48.

than the reverse one. Another advantage of Stoerk's guillotine is the shape of the blade, owing to which it cuts at three surfaces instead of one. Moreover, in the square

shape the corners project, and are more liable to touch and irritate the larynx. This instrument is well adapted for the removal of large tough growths where some force is required. It sometimes happens that firm pressure is required to push the growth into the fenestrum, and in this case the strong frame is very valuable.

For smaller growths Stoerk has lately made a great improvement in his guillotine (*a*). He found that the first form was not unfrequently too large, so that a small growth might slip out before the blade could be drawn up. The

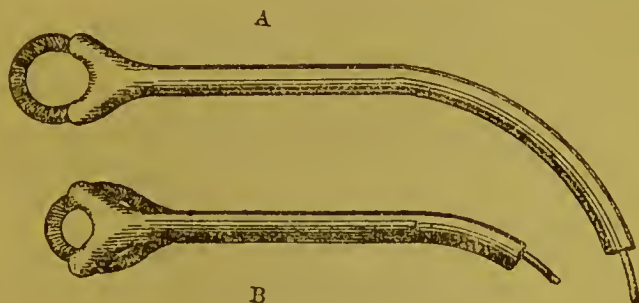


FIG. 49.

size of the fenestrum also prevented its employment when the growth sprang from a vocal cord close to the anterior commissure. Then the protecting sheath covered its own thickness of the neoplasm, and so left that depth of its base unremoved. To obviate these inconveniences the following changes were made :—The lower part of the protector was dispensed with altogether, only the upper portion, of a crescentic shape, remaining. It fits to the same handle as

(*a*) *Laryngoscopische Operationen*, F. 2, 1872.

the older form. The engraving, Fig. 49, shows the new guillotine, which I look upon as the best ever designed. In Fig. A the fenestrated knife is seen projected. In B it is withdrawn towards the hollowed-out crescentic protector. The blade must always be so placed in the sheath that the flat side of the knife is turned towards the side of the larynx where the polyp is situated, for the concave side of the knife does not permit of so accurate approximation to the laryngeal wall, and therefore the incision may not be deep enough. This guillotine may be pressed with such a degree of firmness as to cut away as exactly as possible the whole of the neoplasm. Obviously the more we have of the growth in the fenestrum of the guillotine the more completely will it be extirpated. Experience has shown how often a portion of the base may be left behind and prove the seat of renewed growth. It is for this reason that cauterisation is so often recommended after the operation. Certainly Stoerk's new guillotine is the best instrument for ensuring the removal of the whole growth, and he himself thinks that it is as well to cut away the normal tissue to the extent of one line rather than to be in uncertainty as to the removal of the base.

Several forms of tube-forceps have been designed, one by Türck, who seems to have contrived almost all sorts of laryngeal instruments. Leiter makes a pair to fit into Stoerk's handle, as seen in Fig. 48 C. In the same handle also fit Winterich's forceps, Fig. 48 B, consisting of two concave blades, which when closed form a half-sphere. The inner edges are sharp, and the blades on their concave side are furnished with two small nooses to catch the growth when cut off. This instrument therefore acts on

the principle of scissors. Several other forms of scissors have also been made. Stoerk has modified Winterich's instrument by removing a heart-shaped portion from the points so as to avoid the risk of catching part of the healthy cord when the growth is situated on one.

Mackenzie's tube-forceps differs from those already mentioned, inasmuch as the blades are fixed points in the perpendicular direction, the tube passing over the shoulder of the instrument, and thus closing the blades instead of drawing them into the tube. The spring is very conveniently placed, so that it can be easily pressed by the index finger; and various blades, opening either laterally or in the antero-posterior direction, can be fixed in the same handle.

Crushing forceps are made of various forms and sizes. One of the commonest is seen also in Fig. 48 D, as adapted for the same handle. Schroetter has modified this instrument for large tough growths by adding strong sharp teeth to the upper blade, and to the lower blade a groove to receive them. The great objection to all crushing instruments is the risk of healthy structures being seized, in which case the tearing away after the crushing would be excessively dangerous.

This brings us to one of the greatest advantages of the common forceps. In using them there is much less danger of such an accident. If a portion of the laryngeal structure be included in the blades it is easy at once to open them and withdraw the instrument. Even when a hard tough growth has been seized, but does not yield to such force as we deem prudent to employ, it can be instantly released.

The common forceps are made of several shapes and sizes, and the blades may be like ordinary dressing forceps or with cutting edges. The latter are the more useful, but should not be too sharp. Fauvel and the majority of Continental operators have the forceps curved like the other instruments depicted in Figs. 47, 48, 49. I have from the commencement recommended a right angle, or, at any rate, a near approach to it. I have also had made forceps bent at angles of about 105° and 75° . The latter are useful in some cases of growths at the anterior commissure.

In demonstrations at the Metropolitan Dispensary, in 1860, and subsequently at the City Dispensary and other institutions, I often enlarged on the convenience of bending *all* laryngeal instruments at a right angle. Even those operators who adhere to the curve find it desirable to make the sweep such as to bring the two ends of their instruments to a position at right angles with each other. In the evulsion of growths the form of the instrument is of much greater importance than in other cases. In his exhaustive monograph on the subject (a) Dr. M. Mackenzie advocates the right angle, which he says he has long employed.

The accompanying engraving, Fig. 50, shows a set of three pairs, bent at the angles I have recommended. The middle one is rectangular, and the one most generally used. I am not aware that any one else has employed the other angles. Some of the blades, it will be seen, are like the ordinary dressing forceps; others have a cutting edge. The figure only shows the instruments

(a) "Essay on Growths in the Larynx." London, 1871.

opening antero-posteriorly, but it is necessary to have others opening laterally. Three or four sizes are also desirable.

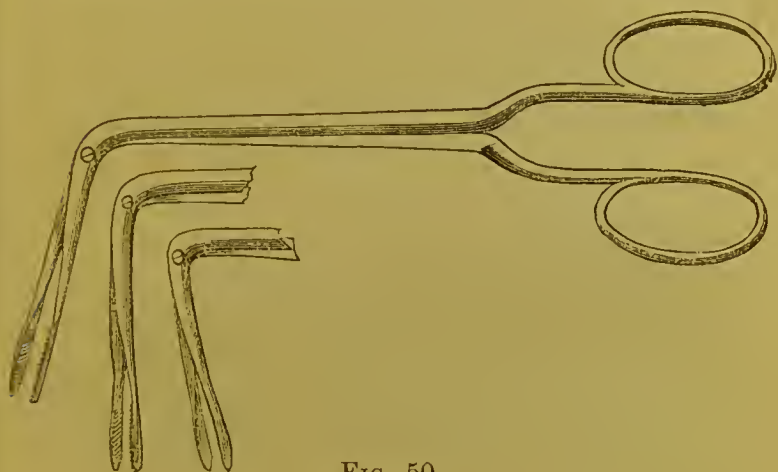


FIG. 50.

A question has arisen as to whether forceps should be slender or comparatively stout. For myself I prefer a medium degree of strength.

The advocates of stout forceps insist on their greater strength, and what is more important, the less degree of vibration. Those who prefer slender instruments assert, truly enough, that they are strong enough for any justifiable degree of force, while they do not obstruct the line of vision so much, and can therefore be more easily watched in the mirror until the growth is actually seized. In connection with this it may be observed that Jellenffy does not pretend to see his forceps after they have entered the larynx, but is guided entirely by his previous knowledge of the position of the growth.

XIV.

General Therapeutics. Remedies reaching the Respiratory Mucous Membrane without the aid of the Laryngoscope. Gargles. The Nasal Douche. The Pharyngeal Douche. Insufflations. Sternutatories. Lozenges. Fumigations. Inhalations. Atomised Fluids or Sprays.

THE attention bestowed on laryngoscopical therapeutics is not intended to extol topical treatment to the exclusion of other remedial agencies. I have always maintained the importance of general treatment, and desire even in a work like this to impress upon the reader the danger of confining his attention entirely to local manifestations and local measures. It is not desirable to enter here on the principles of general therapeutics. These should be familiar to every physician. It is, however, necessary, in order to complete the subject, to speak of several remedies which, though they are not applied by means of the laryngoscope, act locally on the respiratory mucous membrane, and may be considered as supplementary to those spoken of under the term laryngoscopical therapeutics.

Gargles.—The value of this ancient mode of applying remedies has given rise to no little discussion. Some have almost excluded gargles from their practice, while others have relied upon them to a great extent. The former have maintained that they never come in contact with more than the anterior surface of the velum and uvula, and perhaps a portion of the tonsils. The latter have endeavoured to show that they penetrate much further. Even were the first allegation correct there would still be a use for gargles, but it is now generally abandoned.

These diverse views have no doubt partly depended on the inclusion of several distinct acts in the term gargling. A mere mouth-wash may be so employed that the anterior surface of the velum is subjected to its influence. The word gargling, however, is generally understood to imply that the air is to be expelled through the liquid with sufficient force to make the bubbling noise which many seem to consider so essential to the process. But a moment's thought will suffice to show that the liquid may be permitted to remain in the position it occupies as long as the breath can be held, and further, that expiration may be carried on so gently as to prevent the bubbling noise being heard. If now any attempt be made either to swallow or to inspire to a very slight degree, the liquid may pass further, and yet be arrested before it sets up any spasmodic action. The act of gargling may be well studied in conjunction with that of swallowing, and the reader will no doubt be aware of the diversities of opinion that have prevailed respecting the physiology of deglutition. We all know that soft bodies produce little irritation in the larynx compared with hard ones, though,

as previously pointed out, a drop or two of liquid coming unexpectedly on certain parts may at once set up spasm.

It is believed by many that the use of the epiglottis in closing the air passage during deglutition has been somewhat exaggerated. Certainly I have met with many cases in which great destruction of the epiglottis had occurred, —some in which it had been entirely destroyed—without the power of swallowing being greatly affected. On the other hand, we constantly see swelling and ulceration of the epiglottis associated with pain and difficulty in deglutition.

M. Krishaber having masticated and insalivated a little bread crumb, pushed it with his finger over the edge of his epiglottis, and then by an inspiration drew it into the air passage, expelling it again by a sudden forcible expiration. M. Guinier, of Montpellier (*a*), had previously observed on himself by means of the mirror, that such a morsel of soft bread could come upon the closed glottis without causing any uneasiness. The last-named author subsequently attained such command over the parts as to let liquids enter the larynx, and founded upon his experience the plan of laryngeal gargling (*b*). We must remember, however, that the presence of the mirror in the throat during an effort to swallow completely changes the conditions to be studied. In the natural act of deglutition there can be little doubt that the air passage is generally closed. The impossibility of breathing during that act, and the spasm excited by the entrance of small

(*a*) Nouvelles Expériences sur la Déglutition faites au moyen de l'Auto-Laryngoscope.—*L'Union Méd.*, 1865.

(*b*) Etude du Gargarism Laryngien. Paris, 1868.

quantities of the food or drink, seem to show this. Besides, if we eat any substance that will impart a distinct colour to the membrane over which it passes, and then practise auto-laryngoscopy, we find that it discolours the anterior surface of the epiglottis, but not the posterior,—still less the mucous membrane of the vestibule of the larynx.

From what has preceded, it will be readily understood that the act of gargling may vary very much with the individual. Accordingly, we find that some persons never learn to gargle properly, while others achieve what at first seems impossible. The majority of patients, in point of fact, require some instruction respecting the end to be attained. In using a mouth-wash the velum and uvula descend so as to cut off all communication with the pharynx. In gargling, as frequently understood, the result may be almost the same, the liquid coming in contact with the anterior surface of the velum and uvula only. If, however, the patient should now raise the velum, as many can do, some of the liquid will flow into the pharynx. There it produces a desire to swallow, and unless the patient can control this some of it will pass into the cesophagus and stomach. Some persons, however, instead of yielding to the desire to swallow, suddenly jerk the head forwards, and a quick forcible expiration taking place at the same moment, the liquid is expelled through the nose. What they do involuntarily can be accomplished by others deliberately and without inconvenience. In persons possessing this control over the parts we may often obtain good results from a natural nasal douche thus employed.

It is by no means so easy to let the liquid enter the

larynx, and in spite of persistent efforts, many will totally fail in the attempt. Of course, the glottis must be kept closed if the liquid is to rest upon it, and therefore the duration can only be while the patient can hold his breath. M. Guinier, who has demonstrated his method with the laryngoscope, says that the head should not be thrown back, as the less it is raised the less urgent is the desire to swallow. He also advises that the mouth should not be quite closed. With these precautions he takes the liquid into the mouth, brings forward the lower jaw, and closes the glottis by the uncompleted act of emitting a vowel sound. The velum in this disposition of the parts is raised, and the base of the tongue perhaps falls a little, so that the liquid finds its way into the larynx, where, if the patient can completely control the sensibility, it may remain as long as the breath is held. The slightest attempt to inspire will bring on spasmodic cough. Only the few can expect to attain success in this method, and its use is therefore very restricted, especially when we remember that there are other modes of applying liquids to the laryngeal mucous membrane.

At a meeting of the Clinical Society of London on October 24th, 1873, M. Guinier explained and demonstrated on himself his method of laryngeal gargling. He considered the uvula, velum, and often the pharynx to be insensible to ordinary touch. Mr. Prescott Hewett, who, as president, occupied the chair, could not accept this proposition. Dr. Liveing observed that though not quite insensitive, they were far less sensitive than other mucous surfaces in the neighbourhood, and could, with practice, become insensible. Mr. Pugin Thornton pointed

out that in the ordinary mode of gargling the liquid may come in contact with the upper surface of the vocal cords, as shown some years since, by brushing them with a solution of iron, and then gargling with tannin. Dr. Burney Yeo thought that the noise usually produced in gargling went to show that the liquid entered the larynx—surely too great an assumption; and he, as well as Dr. Theodore Williams, considered that gargling was a mere matter of education. This is, as I have previously pointed out, perfectly true. Singers generally acquire considerable control over the parts, while those who have never learned to gargle sometimes find it no easy task.

Astringents are the remedies most frequently required in this form. One of the best gargles is a solution of alum, the strength of which may be varied according to the effect required. Chloride of aluminum may be employed for the same purposes. For a more powerful astringent tannin may be used; one or two drams in half-a-pint of water, to which a dram of rectified spirit or an ounce of glycerine has been added. Borax and chlorate of potass are also useful as both gargles and mouth washes. The former is slightly alkaline as well as astringent; the latter possesses special value in an aphthous condition of the buccal and faucial mucous membrane. As a disinfecting wash and gargle Condyl's fluid is the best. Carbolic acid is a good stimulant to the pharyngeal mucous membrane, but its flavour is so disagreeable that, when indicated, it is better to pencil the parts with the solution, as already mentioned at page 129. I have had excellent results from lactic acid, both as a gargle and in the form of spray. Three or four drachms

may be diluted with 8 oz. or 10 oz. of water. This remedy is of special value in diphtheria. The lactates may be used in the same disease. Mineral acids ought not to be employed as gargles, as they destroy the patient's teeth.

It is obvious that it is not desirable to order gargles for children who have not learned to use them, or for persons whose fauces are so inflamed as to make all movement painful.

The *Nasal Douche* may be mentioned here, inasmuch as it is in one sense supplementary to gargling. By it the fluid is brought into contact with a portion of mucous membrane which, in the majority of persons, is otherwise inaccessible to local treatment such as the patient can employ. The nasal douche is, of course, most serviceable where the disease is located in the posterior nares (*a*), but is also of value in some pharyngeal cases. The nasal passages, as well as the pharynx, may also be medicated by means of syringes and atomisers properly constructed. The liquids most serviceable for the nasal douche are weak saline and alkaline solutions. A dram of chloride of sodium, or half-a-dram of carbonate of soda in a pint of water will suffice. By these the mucous membrane may always be thoroughly freed from the discharges, and thus prepared for other remedies. Astringents may be resorted to in many cases, the

(*a*) See the author's paper on *Ozæna*, read before the Medical Society of London, Oct. 20, 1871, *Medical Press and Circular*, December 6, 1871. Reference may also be made to the author's contribution to the same journal on *Specific Diseases of the Throat* (Jan. 10 and Feb. 28, 1872).

chlorides of aluminum, zinc, and iron being employed in very small quantity. The permanganates are still more useful. The nasal douche should be used tepid at first in all cases. Occasionally, it may be desirable to decrease the temperature, especially when astringents are employed.

The Pharyngeal Douche.—It is easy to direct a stream of liquid on the posterior wall of the pharynx. For this purpose I have arranged mouth-pieces which can be used in place of the nose-piece of the nasal douche. Patients soon learn to employ this method themselves. The liquids are such as have been recommended for the nasal douche, and for gargles, but their strength should be between these two.

Insufflations.—Powders may be applied to the pharyngeal mucous membrane by means of any of the common insufflators. They are often very useful as adjuncts to other treatment—particularly diseases near the orifice of the Eustachian tube, and other conditions giving rise to deafness.

Sternutatories, if old-fashioned, are often useful in diseases of the pituitary membrane, and are readily used by snuff-takers. A great variety of drugs may be employed in this manner, especially astringents.

Lozenges may be looked upon as the modern representatives of the ancient class of remedies termed “hypoglotides,” and which Galen, Dioscorides, and others were accustomed to prescribe. The name was derived from the dose being placed under the tongue of the patient.

The attention bestowed on the process of deglutition in connection with gargling precludes the necessity of considering it in reference to lozenges. The local effect of certain substances on the mucous membrane is often obtained by the employment of lozenges, which should always be allowed to dissolve in the mouth without breaking them by the teeth, and should also be swallowed very slowly, so as to prolong their action as much as possible. It is, however, to be remembered that as lozenges are swallowed their effect on the stomach is not to be forgotten. Indeed, their liability to interfere with digestion is one of their disadvantages. Some lozenges, as those containing morphia for instance, are also used for their general effects. In the British Pharmacopœia there are ten formulæ for lozenges—some, as those of tannin and chlorate of potash, most useful locally ; others, as those of iron and opium, for their effects on the system. The hardness of these lozenges is sometimes an objection. To overcome this, at the Hospital for Diseases of the Throat the lozenges are made of fruit paste, such as is used in the currant lozenges to be found everywhêre.

I have had lozenges made like the ordinary jujubes. The *pâté de guimauve*, so common in France, and indeed all the elegant forms of French pharmacy, may be made equally serviceable. The most useful additions to the lozenges of the British Pharmacopœia are astringents. Of these krameria is one of the best, as its remote effects are less marked than those of other astringents. In tonsillitis guaiacum has been strongly recommended by Sir T. Watson^(a) and others, and can be given in the form of lozenges.

(a) "Lectures on the Principles and Practice of Physic."

Fumigation is a term frequently applied to the plan of drawing the fumes of any substance into the nose, throat, or any part of the respiratory passages. This is accomplished by burning the substance so as to fill the room with the fumes, or by igniting a small quantity in any convenient vessel, and inspiring the vapour as it rises. The former plan is commonly employed for sulphur, and some other substances. As, however, the gas or fume is inspired we might include these under the term inhalations. Unsized paper, saturated with nitre and other substances, when ignited, gives rise to fumes, which have been inspired with benefit, particularly in asthma. Trousseau and Pidoux recommended (*a*) balsamic substances to be heated over a lamp, or thrown upon live coals, so as to fill the room with the anodyne fumes. Iodine gives off its vapour at a low temperature, so that this and other substances can be used in a similar manner. A watch-glass containing a little put in a saucer of hot water is a simple apparatus. The vapor chlori of the British Pharmacopœia requires no apparatus (though it is convenient to have one), and may be called a fumigation.

Inhalations.—This term is commonly restricted to the breathing of steam, either alone or impregnated with medicinal substances, but it is equally applicable to other modes of administering remedies through the respiratory mucous membrane. Some of these have been named under the previous heading, others are the inhalation of gases, of which oxygen is the most important, and for which Barth's apparatus is very convenient. The inhala-

(*a*) "Traité de Thérapeutique." Paris, 1869.

tion of simple steam is a most valuable remedy in a great variety of cases. So useful is it that much of the good effect of many inhalations may be traced to its influence. Great good arises in croup from keeping the atmosphere of the sick-room saturated with steam, and not a few cases of bronchitis find relief from the same plan. In the early stage of acute catarrh the inhalation of steam is most grateful to the patient. It supplies moisture to the dry inflamed surface, and its soothing effect is often manifested by procuring sleep after narcotics have failed. The simplest plan is to inhale slowly the vapour arising from a jug of hot water. A more effectual plan is to take a large sponge, dip it into hot water, squeeze it sufficiently, and then hold it over the mouth and nose, drawing the breath through it. In this way the air is saturated with warm vapour just as it enters the respiratory passages. For simple steam inhalations this plan is the best, but when we desire to add medicinal agents some kind of inhaler is always more convenient, and frequently necessary. Any of the common inhalers will suffice for the purpose, and frequently an ordinary jug may be made to do duty. Nelson's and Maw's inhalers are cheap, and being of earthenware, preferable to all made of metal. When price is no object Mackenzie's "eclectic" inhaler will be found complete.

Any volatile substance can be easily employed in the form of inhalation, and those herbs, the therapeutic value of which depends on an aromatic volatile principle, are often thus used ; or this principle is previously extracted, as in the case of essential oils. The soothing properties of steam are often increased by employing hops — the

vapour of the freshly-made infusion being charged with the sedative properties of the drug. Another aromatic sedative is obtained by putting a teaspoonful of tinct. benz. comp. into the inhaler with a pint of hot water. The vapor conia^s of the British Pharmacopœia is more distinctly sedative—its efficacy depending on the conia being set free by the alkali. It is for this reason that the potash should be added at the time. The succus conii is to be preferred to the extract, as more reliable. The vapor acidi hydrocyanici is employed with cold water, but may be ranked among sedatives. The volatile parts of opium can be utilised by putting the tincture or the solid drug in the inhaler with hot water.

Æther and chloroform may be used with water at a low temperature. In my work on "Sore Throat" I recommended conium, opium, and chloroform in combination, and similar compound inhalations will often prove of service when a simple one fails. It is, however, obvious that very volatile substances may be as well administered without the medium of water. A very simple inhaler, or a little cotton-wool in a cone of paper, will suffice for chloroform, æther, and nitrite of amyl, which I consider should generally be given under the superintendence of a medical man, as it is not well adapted for use when diluted as an inhalation, even at a low temperature.

The late Dr. J.A. Symonds recommended (a) solutions of balsams in æther or pyro-acetic spirit, to be inhaled from an ordinary wide-mouthed bottle, the warmth of the hand holding it being quite sufficient to volatilise the liquid. I prefer æther to the pyro-acetic spirit. Spirit of chloroform

(a) *British Medical Journal*, 1868.

may also be used by this method. Half an ounce of benzoic acid in an ounce of æther forms a standard solution, to which two drams of balsam of Peru, or of Tolu, or of any similar substance, may be added. Turpentine has also been used in this way, but might then be made the menstruum. The essential oils can, if desired, be employed in this manner without steam.

Besides anodyne inhalations, those possessing stimulant properties are most important. In the British Pharmacopœia there are only three—vapor chlori, creasoti, and iodi. The mode of using differs in each case, the hot water being in neither instance employed, while each vapour is a special stimulant. Camphor is a good stimulant for inhalation. Ten drops of the spirit may be put into the inhaler to begin with. It is better to dilute it with more spirit. In like manner most of the essential oils can be used as stimulants. They can be dissolved in spirit or diffused through water by means of magnesia, or powdered silex, in the manner often resorted to for making medicinal waters. The oils of anised, cajeput, cloves, cinnamon, marjoram, myrtle, rosemary, and others are adapted for this purpose. Ammonia is a general stimulant often resorted to.

Atomised Fluids.—Liquids that are not volatile can be made available for inhalation by reducing them to a fine spray. So soluble solids can be dissolved and the solution used in the same manner. All the common atomisers or spray-producers consist essentially of a pair of Bergson's tubes, with an arrangement for driving air or steam through the upper one. The tubes are fixed at right angles to each

other, one descending vertically into a bottle of the liquid to be atomised. The rush of air or steam through the horizontal tube exhausts the perpendicular one, the fluid rises, and is sent forward in a fine spray. In Siegle's inhaler the force employed is steam generated in a boiler by means of a spirit lamp. In Dr. Andrew Clark's hand-ball atomiser, and the many modifications of it, the steam boiler is replaced by a pair of bellows consisting of two india-rubber balls with proper valves. The bottle being held in one hand, and the bellows worked with the other, the spray is inhaled as seen in the engraving, Fig. 51.



FIG. 51.

I have contrived a more simple apparatus, which produces an equally good spray, and is so inexpensive as to place this mode of treatment within the reach of all. In my atomiser the tubes are placed parallel instead of at right angles to each other. The distal end of the upper tube is formed into a cup, which holds enough liquid for

each occasion. The fluid finds its way by gravity to the point, and the air is blown through the lower tube by the ordinary double bellows. This atomiser is much more simple in its construction than any other, as will be seen on reference to the engraving, Fig. 52. The bottle is dispensed



FIG. 52.

with altogether. The tubes being of glass, can be replaced if broken, at a small cost. Messrs. Maw, Son, and Thompson are the makers, and supply the atomiser complete for 3s. 6d., and any chemist will sell it at 4s. 6d. The glass tubes alone they sell at 15s. per dozen.

My atomiser is easier to use than more complicated instruments at three or four times its price, and will be found the most convenient apparatus wherever it is desired

to use a spray. I find in practice that sprays are generally useful when it is an advantage to give them cold ; while for warm applications I mostly resort to the common mode of inhaling steam impregnated with the remedy. It is mostly advisable to administer astringent sprays cold, though of course they may be used warm. Anodynes are applicable either way, but more frequently should be taken warm. A great advantage of my atomiser is, that the tubes can be held far enough in the mouth to prevent the spray spreading over the face, which can only be prevented with steam atomisers by the use of Beigel's screen. After warm inhalations it is often desirable for the patient not to go into the open air or into a cold room ; but the cold spray is the best possible preparation for such sudden changes of temperature.

The remedies most commonly used in the atomiser are solutions of metallic salts. As astringents, sulphate and chloride of zinc, alum, perchloride of iron, and sulphate of iron. The strength of the solutions of these salts may vary from three to ten grains in the ounce, or more, according to circumstances. Permanganate of potass, five to ten grains per ounce, is disinfectant and stimulant, and in some cases exercises a most happy influence on mucous membranes. Carbolic acid, three to five grains, is a good stimulant when the membrane is unusually dry. Lactic acid—already mentioned as a gargle—has been strongly recommended as a solvent of the false membrane of diphtheria. About half a dram in the ounce will be strong enough.

Nitrate of alumina was tried by Dr. Beigel (*a*), who

(*a*) "On Inhalation." London, 1866.



also used many other substances, including acetate of lead, chloride of sodium, and even cod-liver oil.

Demarquay recommends glycerine to soothe an irritated pharynx, and Dr. Scott Alison has employed this fluid in laryngitis and tracheitis. Laudanum and solution of the salts of morphine can be used in the form of spray, five minims to twenty at a time, properly diluted. In asthma success seems to have followed Fowler's solution, five minims at a time, administered in this manner.

Sulphurous acid is generally prescribed too diluted. It may be employed pure, as advised by Dewar (*a*) and Pairman (*b*), or it may be diluted with one, two, or three parts of water. Mr. Durham (*c*) thinks it may be mischievous, but I have not found it so. Tannin, as an astringent, varies much in the dose, and is often given too weak to be effectual.

In conclusion, the atomiser has been used to fill the patient's room with aqueous vapour, or with a solution of sea-salt, so as to make an artificial sea-air, or with carbolic acid or other medicinal agents. Though the plan has now been some time before the profession, it has probably even yet not received the extension to which it is destined.

(*a*) "On the Application of Sulphurous Acid to the Prevention and Cure of Contagious Diseases." Edinburgh, 1867.

(*b*) "The Great Sulphur Cure brought to the Test." Edinburgh, 1868.

(*c*) Holmes' "System of Surgery," vol. iv., p. 533.

P L A T E S .

PLATE I.

FIG. 1.—The Laryngeal Image presented in a Case of Acute Laryngitis. There is hyperæmia of the whole mucous membrane ; gorged vessels are distinguishable in several localities, one on the left vocal cord and others on the epiglottis being particularly observable. There is also great swelling about the arytenoids, the natural form of the parts being thus changed, and two globular red swellings being prominent.

FIG. 2.—Chronic Laryngitis. The hyperæmia is here less intense and more diffused, but still very distinct. The left vocal cord is most affected.



PLATE II.

FIG. 1.—Here a large fleshy-looking growth is seen to occupy the anterior half of the glottis. It was intimately connected with the right vocal cord. I removed the growth, and the patient completely recovered, the voice having been quite restored.

FIG. 2.—Wide-open Glottis, showing the Rings of the Trachea and the Bifurcation of the Bronchi. The form of the larynx is normal, but there is deficiency of colour. This anaemia contrasts strongly with the hyperaemia of Plate 1. This patient became consumptive. Anaemia of the larynx should be regarded as a suspicious symptom.





PLATE III.

FIG. 1.—Enormous Swelling of the Arytenoids. The right is the most swollen, but the left is more congested. Swelling of this kind is more frequently met with in consumption, and has sometimes been spoken of as pathognomonic of phthisis. It may, however, arise from other causes. In consumption it is usually paler than in this case.

FIG. 2.—Consumption. The epiglottis is ulcerated at the edge, and has the appearance of a saw or of being worm-eaten. The swollen condition of the arytenoids is also seen, and they are less congested than in the previous Figure. There is also an ulcer on the left cord. This was healed, and the case is a most satisfactory instance of arrested consumption. It is so often stated that such cases are hopeless that it is a delightful duty to depict this and report the recovery.



1





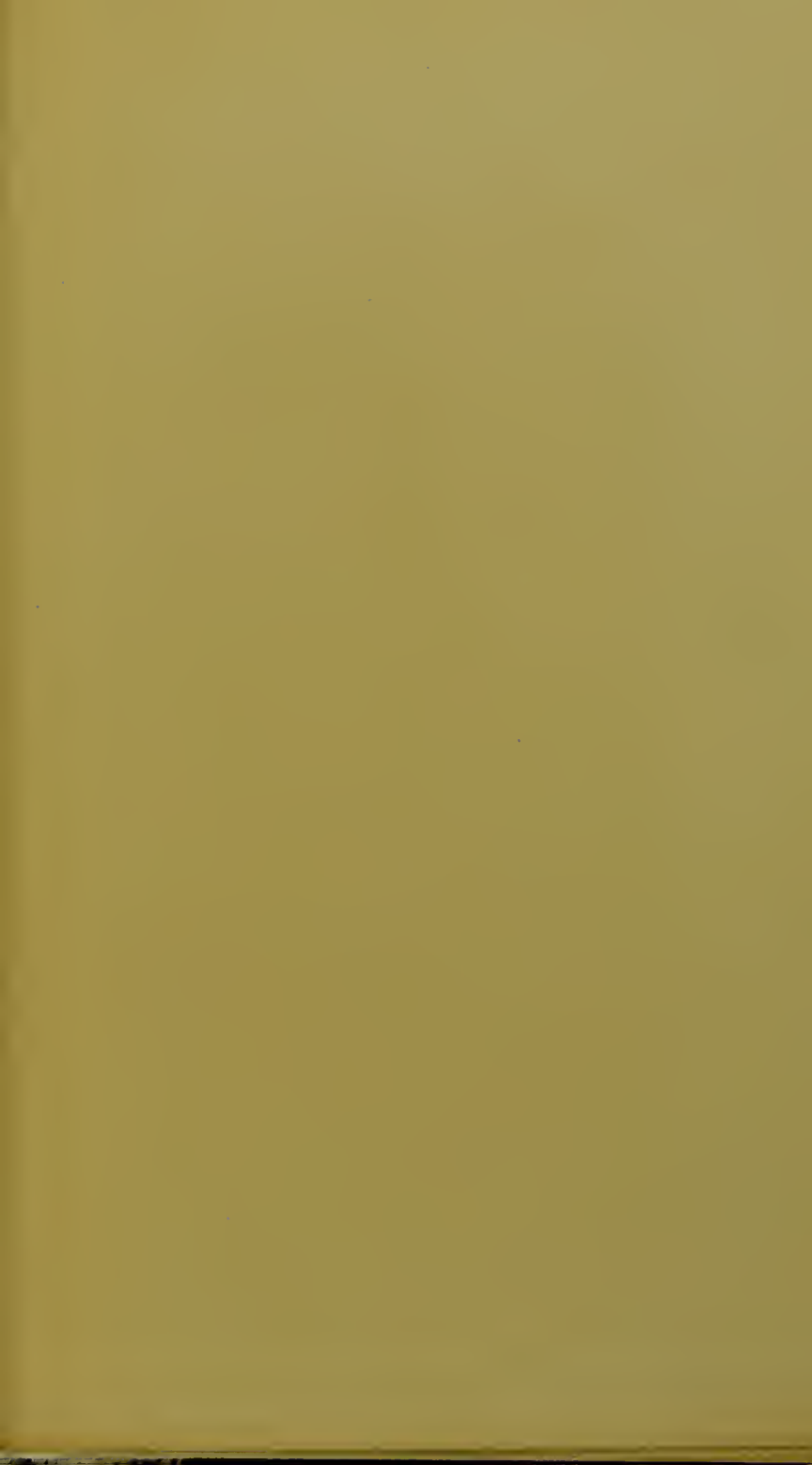


PLATE IV.

Rhinoscopic Image. In a Lesson on Rhinoscopy, pp. 69 to 80, I have fully described the appearance of the parts in health. Here I hope to diminish the difficulties of the beginner by a picture of what he is to look for. The two sides of the image are drawn at a distance from each other. On one I have had the names of the most prominent parts engraved, but not on the other. The two halves may, therefore, be carefully compared with each other, and afterwards with

PLATE V.,

Which represents the complete Rhinoscopic Image in health, showing the natural colour of the several parts. Great pains have been expended on these two plates, and nothing of the kind having been previously produced, I think they will be found to facilitate the study of rhinoscopy.















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